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PROF. W. M. GROSVENOR IN THE CHAIR.

THE VOLUMETRIC DETERMINATION OF TIN.

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(Abstract.)

In this paper the aim has been to present the different volumetric methods which have been advanced for the determination of tin, pointing out the advantages and disadvantages of each. Some of the references most often quoted in this article are:—

A. H. Low, "Technical Methods of Ore Analysis," Fourth Edition.

J. W. Mellor, "Quantitative Inorganic Analysis," 1913 Edition.

L. Parry, "Assay of Tin and Antimony," Second Edition.

Tin is one of the elements for which volumetric methods seem to be specially advantageous because many other elements interfere with the gravimetric methods for its determination.

Nearly all of the proposed volumetric methods for tin which have proved satisfactory require a hydrochloric acid solution. When possible the finely-ground sample is dissolved directly in hydrochloric acid; in some cases the addition of a small quantity of potassium chlorate, antimony chloride, or platinum chloride, or the presence of a piece of platinum foil, accelerates solution. In the analysis of materials containing sulphides or certain alloys, a mixture of hydrochloric and nitric acids may be used, followed by treatment with sulphuric acid and then with hydrochloric acid. Silicious products frequently respond to treatment with hydrofluoric acid.¹

Samples containing insoluble tin oxide may be reduced by treatment with zinc in boiling dilute hydrochloric acid.² The oxide may also be reduced by heating in a current of hydrogen or coal gas,^{3,4} following treatment with nitric acid. Heating with metallic zinc to a high temperature may also be employed in certain cases.⁵

For the decomposition of insoluble silicates, fusion with alkali carbonates is effective. Practically all silicates are decomposed by this process, but it cannot be used with spinel.⁶ The method is not suitable for use with samples containing insoluble tin oxide, and if sulphides or salts of tin soluble in acids are present they must be removed before the fusion process is applied. The addition of 10% of borax to the alkali carbonate accelerates the decomposition in some instances.⁷ Addition of sulphur to the alkali carbonates has also been proposed,⁸ but the method does not appear to possess any advantages.

Fusion with potassium cyanide has been suggested for the reduction of tin oxide,⁹ but though the results are fairly concordant, they are generally lower than those obtained by other methods.¹⁰

Acid-insoluble residues may be decomposed by fusion with sodium or potassium hydroxide,¹¹ the melt being subsequently dissolved in hydrochloric acid. This method is perhaps the most useful of the fusion processes, since it is applicable to almost all products and generally requires only a very simple preliminary acid treatment. An iron crucible is the most suitable for use with this process.¹²

Sodium peroxide may also be used for the fusion process,¹³ but it corrodes the crucibles very rapidly, and generally its disadvantages more than offset the extra speed gained by its use. The addition of organic matter to the peroxide, to furnish the necessary heat for the reaction, has been suggested¹⁴ as a means of preventing the corrosion. Quieter fusion results if zinc sulphide,¹⁵ iron sulphide, or potassium persulphate¹⁶ is added to the peroxide.

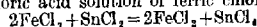
Sintering with zinc oxide has been proposed by J. J. Beringer¹⁷ for the decomposition of insoluble tin oxide, which is thus converted into zinc stannate soluble in hydrochloric acid. H. W. Hutchins¹⁸ has suggested the use of calcium oxide or carbonate in place of zinc oxide; in this case calcium stannate is produced, the action being more complete than when zinc oxide is used.

Volumetric methods.

Of the various volumetric methods which may be used for the determination of the tin, nearly all of those which have met with any degree of success depend upon the oxidation of stannous to stannic chloride, generally in hydrochloric acid solution. Only three exceptions need be noted, first the titration of stannic chloride with potassium ferrocyanide; second the solution of metallic tin in ferric chloride followed by the titration of the ferrous chloride produced with potassium permanganate or potassium bichromate; and third the oxidation of sodium stannite to stannate with iodine, which is really the oxidation of stannous chloride in alkaline solution. Methods one and two are unsatisfactory, are hardly ever used, and will not be further discussed. Method three will be described in detail.

Among the methods which depend on the oxidation of stannous to stannic chloride, the following may be mentioned:—

Titration with ferric chloride.—This method, which is known as Menes' method,¹⁹ consists in oxidising the stannous chloride solution with a hydrochloric acid solution of ferric chloride:



One drop of the standard solution in excess gives a decided yellow colour to the previously colourless solution, provided it is hot and strongly acid.²⁰ The titration should be performed as rapidly as possible and by daylight or, in case of an emergency, by magnesium light, but never by electric light or gas. It has been shown²¹ that if a blue Bunsen flame be examined by looking through the solution being titrated, it will appear to have a greenish colour as soon as a trace of ferric chloride is present. Other suggestions for more accurately determining the end point are the addition of a drop of potassium thiocyanate and titrating until a persistent red tint appears,²² and the addition of potassium iodide and starch indicator and titrating to a permanent blue.²³

The presence of chlorides of lead, zinc, aluminium, iron, cobalt, nickel, antimony, copper, and cadmium does not affect this titration, except that the presence of a large amount of ferrous chloride retards the finish and lessens the delicacy of the end point. Cobalt and nickel give highly coloured solutions which mask the end point to some extent. Bisulph and mercury are reduced to the metallic state by stannous chloride and they should therefore be removed from the solution, as ferric chloride acts on them in this condition. As metallic antimony, copper, and arsenic and tungstic oxide would be precipitated during the reduction of the tin and would be attacked by

hot ferric chloride in acid solution, they must also be removed.

The most successful manner of carrying out this method is said²⁴ to consist in dissolving the metallic tin in hydrochloric acid in a non-oxidising atmosphere and rapidly titrating the solution so produced. The solution should be titrated at the boiling point and its volume kept between 150 c.c. and 200 c.c. Precipitated antimony, arsenic, and copper must not be present during the titration.²⁵

If it is desired to separate from cobalt, nickel, iron, and phosphorus, the tin, antimony, arsenic, copper, mercury, bismuth, and some lead and cadmium are separated as sulphides with hydrogen sulphide. The sulphides are dissolved in hydrochloric acid and potassium chlorate and the solution reduced by heating with iron wire, when arsenic, antimony, copper, bismuth, and mercury are precipitated in the metallic state. The solution must be strongly acid to prevent the precipitation of oxychloride of tin. The precipitate is filtered off and the filtrate neutralised with strip zinc, which precipitates metallic tin and lead. The solution is decanted off after testing for tin, and the metallic tin, lead, and excess of zinc are dissolved in the same flask in 180 c.c. of strong hydrochloric acid and this solution containing all the tin is brought to the boiling point. The flask is fitted with a rubber stopper and Bunsen valve to prevent the back flow of air into the flask. A small piece of zinc is added to keep a reducing atmosphere in the flask until the liquid clears and boils. When all the tin and this excess of zinc are dissolved and the solution is at the boiling point, it is rapidly titrated with the standard ferric chloride solution, which is standardised with pure metallic tin.

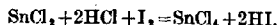
Owing to the difficulty of determining the end point, Lowenthal²⁶ adds an excess of ferric chloride and then titrates the ferrous chloride produced with standard potassium permanganate solution. This seems to be a desirable modification, but adds to the length of the method and makes the removal of interfering elements even more necessary.

It has been suggested that a more satisfactory end point, for the ferric chloride titration, may be obtained by using an indicator containing hydriodic acid, cuprous iodide, potassium iodide, and starch solution.

Direct titration of stannous chloride with potassium permanganate or potassium bichromate.—This method²⁷ gives a correct determination of the tin only when all the tin is in the reduced form and there are no other elements present which are oxidised by the standard solution. Because so many other elements interfere, this method in its simpler form has very limited application and if the interfering elements are separated, it becomes too complicated to be useful.

Titration of stannous chloride with iodine in alkaline solution.—In this method, known as Lensen's,²⁸ the tin is brought into hydrochloric acid solution and one or two grams of Rochelle salt added together with an excess of sodium bicarbonate. If enough tartrate is present, the solution will be clear. The cold solution is then titrated with N/10 iodine. The method has been almost entirely superseded by the titration with iodine in acid solution.

Titration of stannous chloride in cold hydrochloric acid solution with standard iodine. This is called the Pearce-Low²⁹ method, and is one of the simplest, shortest, and most accurate for the volumetric estimation of tin. It depends on the oxidation of stannous chloride in cold hydrochloric acid by iodine to stannic chloride according to the equation:



Starch solution is used as indicator. A small amount of sulphuric acid is not objectionable, but nitric acid and nitrates must not be present.

In the final hydrochloric acid solution, the tin will usually be found in the stannic condition and must be reduced to the stannous condition before titration. This reduction is usually accomplished in one of four ways, by the use of iron in the form of rods, nickel or aluminium in the form of sheets, or strips, or finely powdered antimony. Only pure soft iron may be used. If carbon is present in the iron, it will generally cause high results.

The use of aluminium renders this part of the method somewhat uncertain and makes it difficult to control the operation. The principal objection to the use of antimony is that the presence of so much finely powdered material in the solution obscures the end point. The only objection to nickel is the light green colour given the solution, but this does not affect the sensitiveness of the end point if the concentration of nickel salts is only that derived from the metal used for the reduction.

The reduction and titration are best performed in an atmosphere of carbon dioxide and in a solution containing not less than 25%, nor more than 40% by volume of free strong hydrochloric acid, and the temperature of the solution to be titrated should not exceed 22° C.

One-half to two grms. of the sample (depending on the percentage of tin) is first brought into hydrochloric acid solution. The solution is transferred to a 12-oz. wide-mouth conical flask, enough strong hydrochloric acid is added to make a total of 50 c.c. of free strong hydrochloric acid present, and the solution is diluted to 200 c.c. with water. A nickel coil is prepared by rolling 6 sq. in. of heavy sheet nickel (4 in. long and 1½ in. wide) into a loose roll of such a size that it may be easily inserted into the flask. A narrow strip of nickel is left attached to one side of the coil long enough to reach above the top of the flask. This coil is placed in the flask containing the tin solution, the nickel strip is bent over the edge and the flask is covered with a small watch glass. The solution is heated to boiling and gentle ebullition is maintained for thirty minutes after all the iron, which may be present, is reduced. This is indicated by the yellow colour of the solution changing to a pale green. Thirty minutes is more time than is necessary for the complete reduction of the stannic chloride from 0.5 gm. of tin oxide, and if complete reduction does not result in that length of time, either the nickel coil is too small or the nickel is inactive, due to impurities, and should be discarded and replaced by pure nickel.

It has been stated as an objection to this method, that it is impossible to tell when the reduction of the tin is complete and that the operator may titrate the solution before the tin is all in the lower form. The author has found that larger amounts of tin than would ever be taken as a sample are entirely reduced long before the expiration of the time allowed for the reduction, and no trouble need be experienced from this cause.

The solution in the flask is cooled in an atmosphere of carbon dioxide generated by adding two 4-in. cubes of crystalline marble to the solution. The nickel coil is then removed and is washed with cold hydrochloric acid solution (1 of strong acid to 3 of water) as it is withdrawn from the flask. A small amount of starch solution³¹ is then added and the solution titrated at once with standard iodine.

The standard iodine solution most convenient for this titration is prepared by dissolving 10.7 grms. of iodine in 50 c.c. of water containing 20 grms. of potassium iodide in solution, and making up to one litre with water. When a half-gram sample is taken for analysis, 1 c.c. of this solution will equal 1% of tin. It may be standardised against tin or arsenious oxide.³⁰

Few of the elements which are ordinarily found in materials to be analysed for tin interfere with this

method. Nickel, cobalt, manganese, molybdenum, uranium, chromium, aluminium, zinc, lead, calcium, magnesium, sulphates, phosphates, bromides, iodides, and fluorides have no effect³² unless present in so large amount that their colour masks that of the indicator. Arsenious and antimonious compounds in weak acid solution consume iodine, but in a hydrochloric acid solution of the strength used in this method, they have no effect.³³

If 0.1 gm. or more of antimony is present in the solution, the nickel coil will precipitate metallic antimony in a very slimy condition which does not settle and obscures the end point. This may be prevented by using a solution containing more hydrochloric acid. If therefore the sample taken contains 0.1 gm. or more of antimony, the solution is made up to contain 75 c.c. of free strong hydrochloric acid instead of 50 c.c. in 200 c.c. of volume, before reduction. If this is done the precipitation of slimy antimony will be prevented and no trouble will be experienced. If the antimony content is not known and the slimy antimony begins to precipitate during the reduction, an additional 25 c.c. of strong hydrochloric acid may be added, which will generally cause the antimony to dissolve and prevent further precipitation. If the precipitated antimony does not dissolve, another sample can be treated, adding more hydrochloric acid before reduction.

Copper in small amounts has no effect on the method, but if 0.05 gm. or more is present in the solution, it will be incompletely precipitated during the reduction, the titration will consume more iodine than is required by the tin, cuprous iodide will be precipitated, and the results will be erratic and high.

If copper is present in the sample in large enough amount to interfere, it must first be removed by treatment with nitric acid.³⁴

Bismuth is precipitated in the metallic form during the reduction with nickel. In this form it is said to consume iodine³⁵ slowly but the action is very slight, and unless present in large amount, its effect is negligible. If it is desired to remove it, the metallic precipitate may be filtered and the filtrate again reduced and finished as usual.

Tungsten is reduced by the nickel coil to a lower state of oxidation, with the formation of a blue precipitate, said to be W_2O_3 .³⁶ This is said³⁷ to be slowly oxidised by iodine, thus giving high results, but the oxidation is not proportional to the amount of tungsten present. Tungsten in amounts usually met with does not interfere to any extent, and its effect is only noticeable when it is present in large quantity. In case it should be desirable to separate the tungsten, the blue oxide may be filtered off with the precipitated bismuth, the solution afterwards being again reduced and titrated.

Titanic chloride is reduced to titanous chloride by the nickel coil. In the Pearce-Low method, titanium alone or with iron is said to consume no iodine,³⁸ but in the presence of tin, large amounts of titanium will consume iodine, giving high results. The error caused by titanium seems to be approximately a constant one and is independent of the amount of titanium present. Titanium may best be removed by converting the tin to insoluble oxide by evaporation with nitric acid and then fusing for 5 minutes with potassium bisulphate. The melt is dissolved in water and sulphuric acid and filtered.

If titanium and tungsten are both present, the tungsten will remain with the tin after filtering the extracted melt of the bisulphate fusion. The tungsten may be removed from this residue by heating with ammonium carbonate solution, in which the tin is insoluble.

The removal of titanium as volatile fluoride by evaporation with hydrofluoric acid is not complete

if the titanium is in the form of ilmenite, the double oxide of titanium and iron.

Neither bismuth, tungsten, nor titanium, in any reasonable amount, such as is usually met with, interferes with the method, and may in general be neglected, especially if the titration is performed rapidly which, to a large extent, will eliminate secondary reactions. The interference of all of these metals is greatly increased by very slow and careful titration, which seems to accelerate their action and give them time seriously to affect the results. This is especially true of titanium, for bismuth and tungsten are not so active and as a rule need not be considered.³⁹

Ferrous chloride is oxidised only by excess of iodine and no action takes place unless a very large amount of iodine is run in and allowed to stand. Its action is very slow even then, and the presence of iron does not affect the accuracy of this method.⁴⁰

A tin determination may be run through and results obtained by this method in about one and a half hours and the method is accurate to about 0.1%.

FOOTNOTES.

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- ² J. S. C. Wells, *Sch. of Mines Quart.*, **12**, 295.
- ³ L. Parry, *loc. cit.*, pp. 34; J. W. Mellor, *loc. cit.*, p. 208; J. S. Wells, *Sch. of Mines Quart.*, **12**, 295.
- ⁴ W. Müller, *Pogg. Ann.*, **107**, 138.
- ⁵ T. Moore, *Chem. News*, **87**, 267.
- ⁶ P. W. Shimer, *J. Amer. Chem. Soc.*, **10**, 501.
- ⁷ H. N. Warren, *Chem. News*, **87**, 216.
- ⁸ J. W. Mellor, *loc. cit.*, p. 270; A. Froehde, *Pogg. Ann.*, **119**, 317; E. Donath, *Zeit. Anal. Chem.*, **19**, 23.
- ⁹ J. W. Mellor, *loc. cit.*, p. 269; C. L. Bloxam, *J. Chem. Soc.*, **18**, 97.
- ¹⁰ L. Parry, *loc. cit.*, p. 33.
- ¹¹ J. W. Mellor, *loc. cit.*, p. 266; A. H. Low, *loc. cit.*, p. 208; L. Parry, *loc. cit.*, p. 33; R. L. Hallett, *Eng. and Min. J.*, **87**, 23.
- ¹² A. H. Low, *loc. cit.*, pp. 208, 211, 213; J. W. Mellor, *loc. cit.*, p. 266; R. L. Hallett, *Eng. and Min. J.*, **87**, 23.
- ¹³ J. W. Mellor, *loc. cit.*, pp. 266, 267.
- ¹⁴ J. W. Mellor, *loc. cit.*, p. 267; S. W. Parr, *J. Amer. Chem. Soc.*, **22**, 646.
- ¹⁵ J. H. Walton and H. A. Scholz, *Amer. Chem. J.*, **29**, 771.
- ¹⁶ S. W. Parr, *J. Amer. Chem. Soc.*, **24**, 167.
- ¹⁷ H. W. Hutchin, *Bull. Inst. Min. Met.*, Feb. 12, 1914.
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- ¹⁹ L. Parry, *loc. cit.*, p. 20; J. W. Mellor, *loc. cit.*, p. 310.
- ²⁰ J. W. Mellor, *loc. cit.*, p. 310.
- ²¹ F. H. Morgan, *Jour. Anal. App. Chem.*, **2**, 169.
- ²² J. W. Mellor, *loc. cit.*, p. 310.
- ²³ C. Victor, *Chem.-Zeit.*, **29**, 179.
- ²⁴ L. Parry, *loc. cit.*, p. 20.
- ²⁵ *Ibid.*, p. 33.
- ²⁶ J. Löwenthal, *J. prakt. Chem.* (1), **76**, 484.
- ²⁷ F. Sutton, *Volumetric Analysis*, 9th Ed., p. 347.
- ²⁸ *Ibid.*, p. 346.
- ²⁹ A. H. Low, *loc. cit.*, p. 208; J. W. Mellor, *loc. cit.*, p. 311; L. Parry, *loc. cit.*, p. 37; F. Sutton, *Volumetric Analysis*, 9th Ed., p. 316; R. L. Hallett, *Eng. and Min. J.*, **87**, 23.
- ³⁰ A. H. Low, *loc. cit.*, p. 210.
- ³¹ A. H. Low, *loc. cit.*, p. 81; J. W. Mellor, *loc. cit.*, p. 312.
- ³² E. A. Wraight and P. L. Teed, *Bull. Inst. Min. Met.*, Feb. 12, Ap. 9, 1914.
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- ³⁴ R. L. Hallett, *Eng. and Min. J.*, **87**, 23.
- ³⁵ E. A. Wraight and P. L. Teed, *loc. cit.*
- ³⁶ Treadwell and Hall, *Qualitative Analysis*, 1907 Ed., p. 441.
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- ³⁹ Wraight and Teed, *loc. cit.*, *Discussion*.
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Communication.

NOTES ON SOME FATTY OILS.

BY SO UCHIDA.

Para rubber tree seed oil.

The oil is obtained from the seed of *Hevea brasiliensis*. One litre of seed obtained from Singapore weighed on an average 364.1 grms. The kernel, which constitutes about 51.0 % of

the seed, contains 52.19% of oil and 6.01% of water. When the kernel was pressed with a screw press, it furnished the following result:—Kernel, 1825 grms. First oil (cold drawn), 554 grms. Second oil (hot drawn), 46 grms. Total amount of oil, 600 grms. Percentage of oil obtained to the kernel, 32.88 %. The yield of oil obtained by pressing is poor.

The oil is a pale yellow liquid having an odour resembling that of linseed oil. In the winter months, it deposits a considerable amount of "stearine." With one drop of concentrated sulphuric acid, the oil assumes a reddish brown colour and after stirring it turns to brown. With nitric acid of sp. gr. 1.3, it assumes a yellow colour. When the oil is heated in a thin layer at 100° C. for 6 hours it dries to a soft film; on continuing the heating for 7 hours more the film remains soft. In the elaidin test no solidification is observed even after 48 hours' standing. The oil needs hardly any rectification, but to decolorise it completely it is best to filter it over 10% of its weight of Kambara earth or to shake it first with dilute sulphuric acid, followed by filtration over 5% of its weight of Kambara earth. It is a drying oil but exhibits weak drying power and in its general properties it resembles Inukaya seed oil. It can be used for the manufacture of paints, varnishes, boiled oil, and oil-cloth, as well as for soap-making.

The physical and chemical constants of the oil are as follows:—Sp. gr. (15° C.), 0.9239. Refractive index (27.5° C.), 1.4720. Butyro-refractometer reading (27.5° C.), 69.5. Acid value, 4.21. Saponification value, 191.9. Iodine value, 130.8 (Hübl's method). Ester value, 187.7. Reichert-Meissl value, 0.30. Hehner value, 95.37.

The mixed insoluble fatty acids are yellow and semi-solid and have the following constants:—Solidifying point, 27.0° C. Neutralisation value, 185.0. Mean molecular weight, 303.3. Iodine value, 116.5 (Hübl's method).

Shiromoji seed oil.

The oil is obtained from the seed of *Lindera triloba* BL., a plant belonging to the family of *Lauraceae*. One litre of seeds obtained from Nagano prefecture weighed on an average 378.9 grms. The yellow kernel, which is found in the greyish brown husk, constitutes about 68.1% of the seed and contains 57.69% of oil and 3.34% of water. When the powdered kernel was pressed in a screw press, the following result was obtained:—Kernel, 3505 grms. First oil (cold drawn), 1034 grms. Second oil (hot drawn), 329 grms. Third oil (hot drawn), 223 grms. Total amount of oil 1586 grms. Percentage of oil obtained from the kernel, 45.26%. Thus one hectolitre of the seed will yield 10.9 kilos. of oil by pressing.

The oil is a pale yellow liquid at the ordinary temperature but solidifies in winter months to a hard white mass. It is odourless and has a pleasant taste. When one drop of concentrated sulphuric acid is added it assumes an orange colour. On being shaken with nitric acid of sp. gr. 1.3, it assumes a yellow colour. It yields no solid product in the elaidin test. The oil is non-drying and has the highest saponification value of all known natural oils. Its high saponification value as well as its low Hehner value indicate the presence of a considerable amount of lower fatty acids, while its low iodine value indicates that the oil is low in unsaturated fatty acids. The content of volatile fatty acids is small as judged from its low Reichert-Meissl value. The oil probably consists chiefly of laurin (saponification value 263.8). The cold drawn oil is pale yellow, but the hot drawn oil is somewhat darker. It can best be decolorised by filtering over 10% of its weight of natural absorbent earth or by shaking

it first with dilute sulphuric acid, followed by filtration over 5% of its weight of natural absorbent earth. The oil is best suited for soap-making.

The physical and chemical constants of the oil are as follows:—Sp. gr. (15° C.), 0.9361. Refractive index (27.3° C.), 1.4732. Butyro-refractometer reading (27.3° C.), 40.2. Acid value, 0.63. Saponification value, 282.0. Iodine value (Hübl's method), 11.88. Ester value, 281.4. Reichert-Meissl value, 2.03. Hehner value, 85.72.

The mixed insoluble fatty acids form a reddish brown liquid and have the following characteristics:—Solidifying point, 14° C. Neutralisation value, 287.1. Mean molecular weight, 105.4. Iodine value (Hübl's method), 12.19.

Callophyllum oil.

Callophyllum oil is obtained from the seed of *Callophyllum inophyllum* L., a tree indigenous to Eastern Africa and Southern Asia. In Japan it grows in Formosa, in the Loochoo Islands, and in the Ogasawara Islands. The green nut is 2.5 to 3.0 cm. in diameter and becomes yellow on ripening. The round, pale yellow kernel which is found in a hard, thick wall is about 1.3 cm. in diameter and constitutes about 33.0% of the seed. One litre of the air-dried seed obtained from the Ogasawara Islands weighed on an average 400 grms.

The kernel, separated from the husk, was dried in the sun, crushed, steamed, and pressed with a screw press, when it gave the following result:—Kernel, 955 grms. First oil (hot drawn), 264 grms. Second oil (hot drawn), 44 grms. Third oil (hot drawn), 15 grms. Total, 323 grms. Percentage of oil pressed from the kernel, 33.83%. Hence one hectolitre of the seed will yield 444 grms. of oil.

The oil thus obtained is a dark green, viscous liquid having a peculiar odour and contains a quantity of resin. In winter months it deposits "stearine" and becomes semi-solid. With one drop of concentrated sulphuric acid, the oil becomes reddish brown. On being shaken with nitric acid of sp. gr. 1.3, the oil assumes a brownish-red colour. In the elaidin test, it becomes a buttery mass after 2 hours. The dark green colour can be removed by shaking with dilute sulphuric acid but not with dilute sodium carbonate solution. It can be used for soap-making and also as an illuminant, but is unfit for edible purposes owing to its poisonous nature, especially when not rectified. It is a semi-drying oil and its high acid value is chiefly due to the presence of a considerable amount of resin.

The physical and chemical constants of the oil from Ogasawara Island are as follows:—Sp. gr. (15° C.), 0.9452. Refractive index (26.3° C.), 1.47925. Butyro-refractometer reading (26.3° C.), 81.6. Acid value, 45.95. Saponification value, 194.1. Iodine value, 95.49 (Hübl's method). Ester value, 148.1. Hehner value, 93.61. Reichert-Meissl value, 0.38.

The mixed insoluble fatty acids form a greenish brown soft mass and have the following characteristics:—Solidifying point, 28–29° C. Melting point, 37° C. Neutralisation value, 190.1. Mean molecular weight, 295.1. Iodine value, 95.4.

Hernandia seed oil.

The oil is obtained from the seed of *Hernandia peltata* Meisn., a tree indigenous to Eastern Africa and Southern Asia. The nut is round and green, but when it ripens a part of it becomes reddish. The flesh of the nut is thin while the kernel wall is thick; the kernel constitutes about 57% of the seed. A sample of oil was forwarded in 1914 from the Office of the Ogasawara Islands. The yield of oil by pressing was reported to be as follows, the press used being a primitive one:—

Kernel, 26,250 grms. First oil (hot drawn), 6832 grms. Second oil (hot drawn), 2063 grms. Total amount of oil, 8895 grms. Percentage of oil obtained from the kernel, 33.89%.

The oil is a reddish brown liquid and has a characteristic odour. It deposits "stearine" in winter months. With one drop of concentrated sulphuric acid, it becomes reddish brown. With nitric acid of sp. gr. 1.4, it assumes a red colour. When it is heated in a thin layer at 100° C. for six hours it dries to a soft film, which remains soft and brittle after heating for a further 7 hours. The oil can best be rectified by shaking with dilute sulphuric acid or by treating with 4% of its weight of 50% solution of caustic alkali. It is a drying oil but its drying properties are rather weak, and the amount of free acid is considerable, as the acid value indicates. It can be used for the manufacture of soaps, boiled oil, and rubber substitute, and also for illuminating purposes.

The constants of the oil are as follows:—Sp. gr. (15° C.), 0.9380. Refractive index (27.2° C.), 1.47735. Butyro-refractometer reading (27.2° C.), 78.3. Acid value, 7.39. Saponification value, 195.7. Iodine value (Hübl's method), 126.1. Ester value, 188.3. Reichert-Meissl value, 1.77. Hehner value, 93.17.

The mixed insoluble fatty acids form a dark green liquid and have the following constants:—Begins to become turbid at 12–13° C. Neutralisation value, 185.7. Mean molecular weight, 302.1. Iodine value, 130.0.

Hakunboku seed oil.

The oil is obtained from the seed of *Styrax chinensis* S et Z. The seed, which ripens in September, is much like an acorn in shape and is about 1 cm. long. One litre of the seed (without cups) weighs 500 grms. on an average. The pale yellow kernel, found in the brown hard husk, constitutes about 48.6% of the seed, and contains 43.71% of oil and 5.45% of water. The seed separated from the husks was crushed and expressed first cold and then hot, when it furnished the following figures:—Kernel, 1518 grms. First oil (cold drawn), 434 grms. Second oil (hot drawn), 29 grms. Total oil, 463 grms. Percentage of oil on kernel, 30.51%. Thus one hectolitre of the seed will yield 7491 grms. of oil.

The cold drawn oil is a pale brownish yellow liquid and remains liquid even in winter months, but the second hot expressed oil is darker in colour and deposits "stearine" on long standing at the ordinary temperature. With one drop of concentrated sulphuric acid, the oil becomes brownish red and on stirring becomes brown. When shaken with nitric acid of sp. gr. 1.3, it turns greenish red. In the elaidin test, no solidification is observed after 5 hours; at the end of 72 hours only a small deposit of buttery consistency is deposited. When heated at 100° C. in a thin layer for 14 hours, it becomes more viscous but does not dry. It can be rectified by filtering over 10% of its weight of natural absorbent earth or by treating with 2% of its weight of caustic alkali as a 50% solution. It is a semi-drying oil and its high Reichert-Meissl value indicates the presence of a considerable amount of volatile fatty acids such as butyric acid. In general properties it closely resembles Yego (*Styrax japonica*) seed oil.

The physical and chemical constants of the oil are as follows:—Sp. gr. (15° C.), 0.9610. Refractive index (27.5° C.), 1.48925. Butyro-refractometer reading (27.5° C.), 99.5. Acid value, 1.73. Saponification value 181.8. Iodine value (Hübl's method), 115.4. Ester value, 180.1. Reichert-Meissl value, 16.45. Hehner value, 92.94.

The mixed insoluble fatty acids form a yellowish

liquid depositing a large amount of a white substance solid at the ordinary temperature, and have the following characteristics:—Begins to become turbid at 14–13.5° C. Neutralisation value, 166.1. Iodine value, 114.7. Mean molecular weight, 337.8.

Akebi seed oil.

The oil is obtained from the seed of *Akebia quinata*, Dene., a climbing shrub indigenous to Japan. The fruit, which is the same size and shape as an European pear, is at first green but becomes partly reddish on ripening. It contains numerous black seeds 0.5 cm. long. One litre of the air-dried seed weighs 600 grms. on the average. The seed being small it was very difficult to separate the kernel from its shell, so the whole seed was crushed and subsequently pressed with a screw press first cold and then hot. The result was as follows:—Seed, 5388 grms. First oil (cold drawn), 721 grms. Second and third oils (hot drawn), 2.92 grms. Total 953 grms. Percentage of oil obtained to the seed, 17.69%. Hence one hectolitre of the seed will yield about 10,609 grms. of oil.

The oil is a pale yellowish brown liquid having a characteristic odour and deposits a considerable amount of "stearine" in winter months; the second and the third oils almost solidify at 12–13° C. With one drop of concentrated sulphuric acid the oil assumes a greenish yellow colour, and on stirring a cochineal red colour. On being shaken with nitric acid, sp. gr. 1.3, it assumes a yellow colour with reddish tints. In the elaidin test, it gives a very soft buttery mass after five hours, the consistency remaining the same even after 72 hours.

This oil is non-drying and its most prominent characteristic is its extraordinarily high Reichert-Meissl value—the highest of any vegetable fatty oil. It also has a high acid value. Thus it contains a considerable amount of lower volatile fatty acids such as butyric acid. The oil can be decolorised by filtering over 10% of its weight of Kambara earth or by shaking with dilute sulphuric acid. It can be utilised for the preparation of soap and Turkey red oil as well as for edible and burning purposes.

The physical and chemical constants of the oil are as follows:—Sp. gr. (15° C.), 0.9340. Refractive index (27.5° C.), 1.46145. Butyro-refractometer reading (27.5° C.), 53.2. Acid value, 25.45. Saponification value, 246.4. Iodine value, 78.38. Ester value, 221.0. Reichert-Meissl value, 39.78. Hehner value, 85.80.

The mixed insoluble fatty acids form a pale greenish solid, becoming pale yellow on long standing. They have the following characteristics:—Solidifying point, 31° C. M. pt., 38–39° C. Neutralisation value, 191.7. Mean mol. wt., 292.7. Iodine value, 77.78.

Kuromoji seed oil.

The oil is obtained from the seed of *Lindera serica* BL, a small tree belonging to the family of *Lauracea*. The seed is round, 0.5–0.7 cm. in diameter, and one litre of the seed weighs about 492 grms. on an average. The yellow kernel, which is found in a black brown husk, constitutes about 63.3% of the seed and contains 69.60% of oil and 3.25% of water. The kernel roughly separated from the husks—the complete separation is very difficult—was crushed, then steamed and subsequently pressed with a screw press while still warm. 905 grms. of kernels yielded 340 grms. of first oil (hot drawn), 105 grms. of second oil (hot drawn), and 20 grms. of third oil (hot drawn). Total amount of oil, 525 grms. Percentage, 58.02%. One hectolitre of seed will thus yield about 18,045 grms. of oil.

The oil is a yellowish brown liquid having an aromatic odour, and does not solidify even in winter. When one drop of concentrated sulphuric acid is added to 20 drops of oil placed on a white porcelain plate, it assumes an orange-brown colour. With nitric of sp. gr. 1.3, the oil becomes yellowish red. In the elaidin test it remains liquid even after 48 hours' standing; only a small deposit of buttery consistency was found. It is non-drying and its high saponification value as well as its low Hehner value indicate the presence of a considerable quantity of the lower fatty acids, while its low iodine value indicates that the content of unsaturated fatty acids is low. Again the content of volatile acids is low as indicated by its low Reichert-Meissl value. Complete decoloration of the oil is difficult, but when it is treated with 1% of caustic alkali as a 50% solution and then filtered over 10% of its weight of Kambara earth, it is fairly well decolorised. The oil can best find application in soap-making.

The physical and chemical constants of the oil are as follows:—Sp. gr. 30°/30° C., 0.9401. Refractive index (27° C.), 1.4680. Butyro-refractometer reading (27° C.), 65.2. Acid value, 18.78. Saponification value, 255.6. Iodine value, 65.29 (Hübl). Ester value, 236.8. Reichert-Meissl value, 2.53. Hehner value, 86.22.

The mixed insoluble fatty acids are a dark brown liquid, having solidifying pt. 9.5° C., neutralisation value 262.0, mean mol. wt. 214.1, iodine value 37.

Aburachan seed oil.

The oil is obtained from the seed of *Lindera praecox*, a tree belonging to the family of *Lauracea*, growing in Shikoku, Kyushu, and Honshu, Japan. The seed is round, 1.0–1.3 cm. in diameter, and contains a pale yellow kernel in a reddish brown husk. One litre of the air-dried seed obtained from Nagano prefecture weighs on an average 432.3 grms. The kernel, constituting 80.7% of the seed, contains 29.44% of oil and 7.35% of water. The oil was prepared by steaming and pressing the powdered kernel. The result was as follows:—Kernel, 6348 grms. First oil (hot drawn), 790 grms. Second oil (hot drawn), 101 grms. Third oil (hot drawn), 150 grms. Fourth oil (hot drawn), 52 grms. Total, 1153 grms. = 18.17% of the kernel. Hence one hectolitre of the seed will yield about 6341 grms. of oil by pressing.

The oil is a dark brown liquid possessing a somewhat aromatic odour. It solidifies in winter. When one drop of concentrated sulphuric acid is added to 20 drops of oil a brownish red liquid is produced. With nitric acid, sp. gr. 1.3, it becomes red. In the elaidin test, it remains liquid even after 72 hours, at the end of which time only a minute quantity of buttery consistency is formed. This oil is non-drying and its saponification value exceeds that of coconut oil, indicating the presence of a large amount of lower fatty acids. The amount of volatile fatty acids is small as shown by its low Reichert-Meissl value.

The oil can best be purified by filtering over 10% of its weight of Kambara earth or by shaking with dilute sulphuric acid.

The physical and chemical constants of the hot drawn oil from Shinano province seeds are:—Sp. gr. (15° C.), 0.9348. Refractive index (27° C.), 1.4550. Butyro-refractometer reading (27° C.), 43.6. Acid value, 2.60. Saponification value, 273.8. Iodine value, (Hübl), 20.53. Ester value, 271.0. Hehner value, 89.21. Reichert-Meissl value, 1.39.

The mixed insoluble fatty acids, which are liquid and reddish brown, have solidifying pt. 13° C., neutralisation value 277.2, mean mol. wt. 202.4, iodine value 18.28.

Magnolia fruit oil.

The oil is obtained from the fruit of *Magnolia hypoleuca* S. et Z., a large tree growing in Shikoku, Kyushu, and Honshu, Japan. The fruit is red, ellipsoidal, and 1.0–1.3 cm. long. The pale yellow flesh is thick and rich in oil. The black kernel is 0.7–0.9 cm. long and has very thick and hard walls. One litre of the fruit weighs 637 grms. on an average. The flesh and the kernel (kernel wall and kernel) are in the ratio of 45:55. The kernel separated from its wall contains 59.60% of oil and 4.69% of water. The fruit of *Magnolia hypoleuca*, without separating its seed and flesh, was crushed and pressed with a screw press, when 4055 grms. of the fruit yielded 1270 grms. of first oil (cold drawn), 217 grms. of second oil (hot drawn), and 74 grms. of third oil (hot drawn); total 1561 grms. = 31.51%. One hectolitre of the seed will thus yield about 20.6 kilos. of oil.

The oil thus obtained is dark brown with purple tints, and is very difficult to decolorise. It is viscous and deposits a considerable amount of "stearine" even at the ordinary temperature on long standing. Twenty drops of the oil placed on a white porcelain plate and treated with one drop of concentrated sulphuric acid, assumes a greenish yellow colour which on stirring turns to greenish brown. On shaking with nitric acid of sp. gr. 1.3 it becomes a reddish brown colour. In the elaidin test it deposits a considerable amount of a buttery mass after 5 hours' standing, and after 48 hours the whole mass becomes soft and of buttery consistency. When heated to 100° C. in a thin layer for 14 hours it becomes more viscous but does not dry. It is semi-drying and its somewhat high acid value indicates the presence of free acid in considerable quantity. The oil can be used for soap-making and also as a burning oil.

The physical and chemical constants are as follows:—Sp. gr. (15° C.), 0.9315. Refractive index (26.8° C.), 1.4739. Butyro-refractometer reading (26.8° C.), 72.5. Acid value, 13.43. Saponification value, 224.4. Iodine value, 109.2. Ester value, 211.0. Reichert-Meissl value, 4.93. Hehner value, 93.11.

The mixed insoluble fatty acids are a soft solid of dark brown colour, and have the following characteristics:—M. pt., 35°–35.5° C. Solidifying pt., 28°–28.5° C. Neutralisation value, 201.9. Mean mol. wt., 277.9. Iodine value, 99.66.

Magnolia flesh oil.

The flesh of the magnolia fruit was separated and pressed with a screw press. 1480 grms. yielded 394 grms. of first oil (cold drawn), 129 grms. of second and third oil (hot drawn). Total, 523 grms. = 35.34%.

The oil is dark brown and deposits a large amount of "stearine" in winter months and becomes viscous. The colour can easily be removed by treating first with 2% of caustic alkali as 50% solution, followed by the filtration over 10% of Kambara earth.

The oil gives a green coloration with concentrated sulphuric acid and a yellow colour with nitric acid of sp. gr. 1.3. In the elaidin test it becomes turbid after 5 hours and then separates into two layers, liquid and solid; finally at the end of 72 hours the whole mass becomes buttery. When heated in a thin layer at 100° C. for 14 hours it shows no tendency to dry. It contains a considerable amount of free acid, and can be used as the raw material for soap and rubber substitute, but as it is very difficult to separate the flesh and the kernel, it is not likely to be of any technical importance.

The physical constants of the oil are:—Sp. gr. (15° C.), 0.9239. Refractive index (27° C.), 1.4693. Butyro-refractometer reading (27° C.), 65.3. Acid value, 13.59. Saponification value,

205.0. Iodine value, 89.53. Ester value, 101.4. Reichert-Meissl value, 4.67. Hehner value, 91.83. The mixed insoluble fatty acids are solid and pale brown and have:—M. pt., 36.5° C. Solidif. pt., 32°–32.5° C. Neutralisation value, 205.1. Mean mol. wt., 273.5. Iodine value, 89.16.

Magnolia seed oil.

As the wall of the kernel is very thick and hard, the seed was crushed whole, sifted with a winnowing basket to separate any coarse wall pieces, and subsequently steamed and pressed with a screw press. The yield of the oil was very poor as it was absorbed by the pieces of kernel wall. 3180 grms. of seed yielded 246 grms. of oil or 7.74%.

The oil is a dark brown liquid and is exceedingly difficult to decolorise. It does not solidify even in winter months. Treated with nitric acid it becomes reddish brown. In the elaidin test, no solidification is observed after two hours; at the end of 72 hours a small deposit of buttery consistency is formed. When it is spread in a thin layer and heated at 100° C., it dries after 11 hours. It is a non-drying oil but exhibits weak drying properties. It can be used for the manufacture of soap and boiled oil, but as it is not profitable to press the oil separately from the flesh and the seed it is not likely to acquire any technical importance.

The constants of the oil are as follows:—Sp. gr. (15° C.), 0.9288. Refractive index (27° C.), 1.4754. Butyro-refractometer reading (27° C.), 75.0. Acid value, 6.69. Saponification value, 207.4. Iodine value, 124.5. Ester value, 250.7. Reichert-Meissl value, 0.17. Hehner value, 96.54.

The mixed insoluble fatty acids form a brownish black liquid, which begins to become turbid at 17.5°–17.0° C., and has neutralisation value 193.7, mean mol. wt. 289.6, iodine value 125.5.

Tea seed oil.

This oil is obtained from the seed of the ordinary tea plant, *Thea chinensis*, a shrub largely cultivated in the provinces of Musashi, Suruga, Ise, Yamashiro, and Omi for the manufacture of tea; it also grows wild extensively in Shikoku and Kyushu. In some parts of these districts, the tea plant grows abundantly as undergrowth of the forest. The seed is round, about 1 cm. in diameter, and contains a yellowish white kernel in a blackish brown husk. One litre of the air-dried seed of wild tea plant obtained from Tosa province weighed 380 grms. on the average. The kernel, which constitutes 65.3% of the seed, contains 27.62% of oil and 10.25% of water. The kernel was ground to a coarse meal, then steamed and subsequently pressed while still warm with a screw press. 3384 grms. of the kernels yielded 498 grms. of first oil (hot drawn), 102 grms. of second oil (hot drawn), and 14 grms. of third oil (hot drawn). Total, 612 grms., or 18.09% of the weight of the kernel. One hectolitre of the seed will hence yield about 4488 grms. of oil by pressing.

The oil is a pale brown liquid having a peculiar odour, and deposits a large amount of "stearine" in winter. With concentrated sulphuric acid an indigo blue coloration is produced which becomes greenish brown on stirring. On shaking with nitric acid, sp. gr. 1.3, a pale blue colour is produced. In the elaidin test it became turbid and very viscous after 5 hours, owing to the production of solid matter, and after standing for 24 hours the whole mass assumed a buttery consistency.

This oil is non-drying and in its general properties resembles *Sazanqua* (*Thea sazanqua*) seed oil. The best way to rectify the oil is to filter it over 10% of its weight of Kambara earth, or it may first be shaken with dilute sulphuric acid and then filtered over 5% of its weight of Kambara

earth. It can be used for soap-making and also for lubricating and burning.

The constants of the pressed oil from Tosa province seed are as follows:—Sp. gr. (30°/30° C.) 0.9126. Refractive index (27.6° C.), 1.4609. Butyro-refractometer reading (27.6° C.), 61.6. Acid value, 4.12. Saponification value, 193.8. Iodine value, 86.20 (Hübl). Ester value, 189.7. Hehner value, 95.76. Reichert-Meissl value, 0.10.

The mixed insoluble fatty acids form a pale green, soft solid and have the following characteristics:—Solidif. pt., 25.5° C. Neutralisation value, 190.5. Mean mol. wt., 294.5. Iodine value (Hübl), 80.79.

London Chamber of Commerce.

Special Meeting of Chemical Section, held at the Chamber House, 79, Cannon Street, E.C., on October 27, 1916.

MR. THOMAS TYRER IN THE CHAIR.

The SECRETARY read the notice convening the meeting, the object of which was to consider the general policy of the chemical and allied industries on practical questions arising during and after the War, and what concerted action may be desirable in the common interest.

The CHAIRMAN said that the present definition of trade as mere "buying and selling" was misleading, and the conditions which prevailed to-day were insane. There was little or no consideration for others and an increasing tendency to cut-throat competition. They were told to co-operate and co-ordinate. Co-ordination must involve co-operation, but co-operation did not involve co-ordination. Under co-ordination what would become of the small man in face of the position in which the great men and the great combinations in the last few years had placed him? It was a question as to what combination of the two forms, co-operation and co-ordination, would be the wiser course. In the chemical trade there had been suffering and inconvenience, and after the war the ill feeling, "envy, hatred, and malice," which grew out of it, and the uncharitableness which would necessarily follow, would exist in greater force. There was no sign that any condition of rivalry would be ameliorated, but the contrary, and men who had been free-traders, and who were prepared to show that the commercial success of this country was based upon a system of free trade, were face to face with the success and the competition of a great, able, and determined nation, and it was now a question whether the almost sacrosanct idea or fetish of free trade would be sufficient. It had not done everything in the past, and it had produced a state of things to which, in his opinion, much of the ignorance and *laissez faire* of to-day was due. His personal view was that the trade ought not to be placed in the position of being constantly faced with the mailed fist of a determined, but not industrially demented, nation. The British would require to make the best use of those qualities of forethought, intelligence, industry, and endurance, which they undoubtedly possessed, but which had been allowed to become rusty as a consequence of opulent facilities. He, personally, deplored that British Dyes Limited had been subsidised by the Government, which logically meant that every one who had a "good thing" ought also to be subsidised.

The pressure of war and the necessity for increasing our output had revealed in Great Britain resources in scientific knowledge and engineering which we little thought we possessed. They should

drop subsidies, drop prejudices and conceits, and call in men who could give the right kind of advice. Amongst the greatest hindrances to progress were not the want of knowledge and material, or lack of men, but the want of sane legislation and co-operation. To begin with, the whole condition of the railway service, and the management of labour, and much more, was wrong, for instance, primary and secondary education, but he could not see on the part of the Government true discrimination. The virtual preference accorded to German competitors before the War should be destroyed. It was not protective tariffs alone that would protect or save any trade. Let them put all their brains and energy into co-operative action.

Mr. E. A. B. HONGETTS, of Nobel's Explosives Co., Ltd., said that his Company had not suffered much from enemy competition in the United Kingdom, although they had from the dumping of goods in Australia. There was a great deal to be said in regard to the freight question in this country, but he was not prepared to say what alterations were necessary; the subject was covered by serious complications.

Mr. E. J. BOAKE (Boake, Roberts and Co.) said that across the North Sea organised co-ordination of science and industry with practically unlimited capital were prepared to fight British manufacturers, who were presided over by a Government which knew nothing and cared less about their destiny. The position seemed hopeless. What was needed was direct representation in the House of Commons as a big trade organisation. Was it unreasonable that the greatest key industry in this country should be directly represented in the House of Commons where such questions as railway rates, the Consular Service, and tariffs would have to be dealt with. The Chemical Section had expressed its views very strongly in favour of tariffs to enable them to trade on level terms. If there were no tariffs, what was to become of the quantities of chemicals now lying in Germany, which the Germans would desire to sell immediately after the War. Were we going to allow those goods to enter here? There was the question of the obliging foreign agent who established himself in London, from whom they had previously obtained chemicals of every conceivable kind. In exchange, however, those gentlemen acquired knowledge which it was not in British interests they should have.

Mr. G. H. WILKINSON, of the Wrekin Chemical Co., said that the question of tariffs had been considered by the British Wood Distillers' Association in Manchester a few weeks ago, when the opinion had been expressed that in a commodity like wood-charcoal, where British works are in a position to supply the entire needs of the home markets, a prohibitive duty of £5 per ton should be levied on charcoal coming into the United Kingdom from any source whatever. In the case of acetate of lime and wood spirits, the home manufacturers could not entirely supply the demand, but in view of the great importance of these articles in time of War, the Association had requested that the Government should take steps to foster and encourage home production so as to obtain the maximum production possible in this country.

The CHAIRMAN referred to the fact that no progress had been made in the alcohol question lately, owing to the inability to move the Government officials. He also referred to another good work, to which the Section had been accessory—namely, the transference of the manufacture of caffeine from the foreigner to Britain, by securing suitable denaturants of the raw material, which was retained here instead of going abroad.

Mr. R. PUGH, of the London Chemical Works, Ltd., said that the position of the manufacturers

of salicylates was the same as that of the wood distillers. They were looking for some form of protection which would enable them to establish themselves on equal terms with their foreign competitors. They considered that they should be protected against unfair competition, by proper organisation, and he suggested that the Chemical Section of the Chamber should form a Committee with a view to ascertaining which industries in this country were capable of supplying the needs of Great Britain and the Colonies in various chemical manufactures.

Dr. M. O. FORSTER, F.R.S., expressed the view that the Government assistance to British Dyes Limited was a wise action, especially when they remembered that the German chemical industry had for years received financial assistance either direct from the German Government or from that Government through the German banks. It was just that early assistance in which Great Britain's fine chemical industry had been so lamentably lacking in the past. They had not been able to expend the necessary amount on research chemists, or in the long and patient investigation required, which would not bring in a return for perhaps five or ten years. He thought tariffs would have to be placed on certain articles, but they would have to ascertain the guiding principle which should control their incidence and administration. Where they had a material which would be produced in this country in the amount which was necessary for national requirements, then a tariff should be put on importation in order to assist British industry and to discourage importation. Where they had a material for which there was a practically unlimited demand, and where it would be to the advantage of the country to have a larger quantity than could possibly be produced in Great Britain, then it seemed to him it would be wiser not to place a duty on such an article, unless it was a question of discriminating between our friends and our enemies. It was in the matter of intermediates that Germany had scored.

So far as the re-establishment of the dye industry was concerned, it would take years to approach anywhere near the position which Germany had reached.

Finally, it would be necessary to reform, whatever else was reformed, our system of education, and insist that scientific study should have an equal chance with classical study.

Sir CHARLES BEDFORD, Secretary of the Association of British Chemical Manufacturers, referred to the amount of spadework necessary before his Association could seriously commence its work. They were proposing to form sectional committees which should study, in order of urgency, their requirements, and the requirements of the chemical industry as a whole. He agreed with Mr. Boake as to the necessity for direct representation of the industry in the House of Commons, but what they required now were practical propositions, as it was not likely within the period of the war that they would have such an alteration as would enable representatives of their own or other leading trades and industries to sit in the House of Commons. On the question of tariffs a protective duty by itself would not save an industry; organisation was required. One of the obstacles to be faced and got over was the individual jealousies which were manifest in regard to the immense amount of trade which was done by secret processes, and the subject of pooling was a very dangerous thing to face. The only remedy was to combine in formulating some method by which this difficulty could be got over.

In regard to tariffs the question was so infinitely complex that it would be almost impossible to deal with the subject, and the only solution would be a Standing Board for Tariffs, a Board on which

would sit, side by side with the Government officials, accredited representatives of all the chief industries.

Mr. D. LLOYD HOWARD (Howards and Sons, Chairman of the Manufacturers' Sub-section) submitted that an important consideration in regard to the question before them was that the way lay not in one remedy, but in several. He was very glad to see that the question of tariffs and also differential tariffs against our enemies tended to become less and less a party question amongst business men. There were, of course, extreme fanatics on both sides who would not alter their views. Education, and more of it, was undoubtedly necessary. At the same time we had a great many very good chemists and practical men, who, with our curious national habit of self-depreciation, had not met with the support which they deserved. German-trained chemists included a vast number of mere hacks, only useful to those who are far-seeing and highly trained enough to make use of them.

On such a subject as the present there were a number of things to be taken into consideration, for instance, the operation of the patent laws, which gave a most unfair protection to the foreigner. If they were to examine a number of patents for German fine chemicals, they would find whole groups of compounds protected by a patent, which it was never the intention of the patentee to work, the idea being to prevent their use by other investigators.

There must be a more sympathetic attitude towards a production from the highest to the lowest, and the interests of the community must be more carefully studied and helped on by the Government.

Mr. O. A. HILL (British Drug Houses, Ltd.,

Chairman of the Druggists' Sub-section) said that the Germans had been very active in the past in getting into their hands the control of the supply of certain drugs, which were the only source of certain important chemicals, such as santonin, for which was secured the whole of the Russian supply of the raw material, wormseed.

Egyptian henbane, a source of atropine, was another of the German monopolies. That sort of thing must stop. Nobody was to blame except perhaps our own manufacturers. The time for quarrelling was past, and all our efforts should now be directed to securing co-operation between Government Departments like the Foreign Office, the Imperial Institute, and the fine chemical makers. He was sure that co-operation would lead to better results.

The CHAIRMAN reported that the Chamber's Special Committee on Trade after the War was preparing a third report on the measures to be taken to give full effect to the recommendations of the Economic Conference of the Allies, and particularly the question of commercial and industrial organisation and financial facilities. On this Committee all the Trade Sections of the Chamber were represented and the Report would be ready by the end of the year. The various Sub-sections of the Chemical Section would discuss points which affected them, and the Advisory or Emergency Committee of "Sub-sectional Chairmen" would always be ready to consider any recommendations or suggestions submitted.

It was moved from the Chair, seconded by Mr. Blagden, and agreed:—

"That the questions raised in the discussion at this meeting, as noted, be referred to the respective Sub-sections for consideration and such action as may be practicable."

Journal and Patent Literature.

PATENT SPECIFICATIONS may be obtained by post by remitting as follows:—

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I.—GENERAL; PLANT; MACHINERY.

Acid-resisting iron apparatus; Design of—
N. Swindin. Chem. Trade J., 1916, 59, 323—324.

The general design of plant in which acid-resisting iron alloys are used is similar to that where steel is employed, except that due allowance is made for the greater liability of the alloys to fracture from the action of internal stresses. Unequal cooling being the chief source of trouble in this respect, the thickness of the castings should be as uniform as possible and the presence of relatively large masses of metal (e.g. at the junction of two or more walls of the apparatus) avoided. Although parts with flanges and ground or machined faces are obtainable and sometimes indispensable, plain spigot and socket joints should be used wherever possible; pipe apparatus of the kind under discussion is seldom subjected to high pressures, and excellent cements to withstand every kind of acid liquid or gas are now available for making such joints quite tight. As in the case of other metals used for pans, etc., the most reliable form of casting for acid-resisting iron alloys is a hollow sphere or portion thereof; flat surfaces should be avoided wherever possible, and if unavoidable should not be larger than 18 in. square. The very

shallow pans used for concentration purposes are ribbed and corrugated, thus providing an increased surface for heat transmission and overcoming foundry troubles by breaking up flat surfaces. The advantages of the iron alloys over earthenware, etc., are most apparent in nitric acid plants, chiefly as regards the great reduction in size, and increase in efficiency, of the condensing apparatus. For denitrating sulphuric acid, towers made of iron alloys are very successful, but being slightly attacked by weak (although not by strong) sulphuric acid, cascade basins and pans of these alloys can only be employed in the lower part of the run if iron-free acid is required.—W. E. F. P.

Drying in the chemical industry; Rational—
R. W. Dinnendahl. Chem.-Zeit., 1916, 40, 845—846.

For drying chemical products economically it is important to remove as much of the water as possible from the moist material by mechanical means before applying heat to evaporate the remainder. Two patented devices for removing moisture in continuous operation are described. The first is a rotating vacuum filter consisting of a circular revolving table, the surface of which is divided radially into a suitable number of cells.

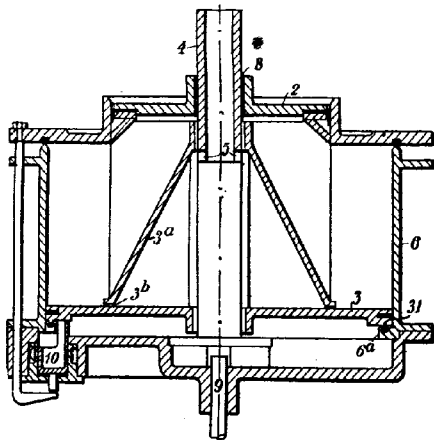
The cells are filled with interchangeable filter frames and connected underneath with a wet air pump. The material to be drained is fed continuously from a hopper on to the filter frames covered with cloth, and spreads itself out into a layer of uniform thickness, being immediately subjected to the suction of the vacuum pump below the frames. As the table rotates, the vacuum is finally broken and the solid material removed by automatic means, assisted if necessary by the application of compressed air in the zone of the discharge operation. Between the removal zone and the feed-zone an arrangement is placed for cleaning the filter frames. The second apparatus is an automatic filter press for dealing with mixtures containing less than 90 % of water. It consists of a cylinder with reciprocating piston which exerts a pressure on the introduced material, regulated by an adjustable cover on the pressure tube which forms an extension of the cylinder. During the backward stroke of the piston the cylinder is charged with material from a hopper; in the forward stroke this material is pushed up into the pressure tube where it is subjected to a gradually increasing pressure with every stroke of the piston, falling out at the end in a solid form on to a conveyor.—J. F. B.

Utilisation of Etna lava in the chemical industry. Pagliani. See VII.

PATENTS.

Separation of solid substances from liquids; Centrifugal machines for the —. R. A. Sturgeon, Llangollen, Wales. Eng. Pat. 7019, May 10, 1915.

In apparatus of the type described in Eng. Pat. 24,038 of 1913 (this J., 1915, 263), liquid is



admitted by the hollow shaft, 4, and passes by the openings, 3^a, in the rotating member, 2, 3^a, 3, to the outer casing, 6, and finally escapes by the outlet, 8, which is nearer to the axis than in the former patent, thus reducing the outflow velocity and consequently the power used. An additional joint between the fixed and rotating parts may be formed by the rib, 31, and the flange, 6^a. The pressure liquid admitted by the pipe, 9, to lift the plate, 3, and allow the discharge of solid matter as in the former patent, may escape tangentially by a valve, 10, in a direction opposite to that of rotation.—W. F. F.

Drying, heating, cooling, or ventilating; Apparatus for —. T. G. Marlow, Streatham, and The Pulsometer Engineering Co., Ltd., Reading. Eng. Pat. 12,988, Sept. 10, 1915.

THE movement of the gas or air through the apparatus described in Eng. Pat. 16,299 of 1911 (this J., 1912, 909) is regulated, or the direction is reversed, by a rotary controller driven by a variable speed motor and a double-valve reversing device.—W. H. C.

Chemical reactions; Receptacles for carrying out —. Norsk Hydro-Elektrisk Kvaestofaktieselskab, Christiania. Eng. Pat. 100,447, May 5, 1916. Under Int. Conv., May 12, 1915. (Appl. No. 6496 of 1916.)

In a receptacle having a discharge pipe at the bottom provided with a sluice valve and an inlet for steam between the valve and the outlet from the receptacle, an additional hand-operated valve is provided to close the outlet from the receptacle so that the pipe may be cleared by steam. The crust at the bottom of the receptacle may be pushed up and broken by raising the valve from its seating. The receptacle may be used in the production of ammonia from calcium cyanamide.—W. F. F.

Constant discharge of a liquid or the like; Means and apparatus for keeping a —. F. Danesi, Rome. Eng. Pat. 101,386, Apr. 6, 1916. (Appl. No. 5049 of 1916.)

A CONSTANT flow from a tank in which the level of the liquid varies, is maintained by means of a siphon which is supported by a frame and float, so that the level of the discharge orifice of the siphon is always the same distance below the level of the surface of the liquid.—W. H. C.

Classifier. H. B. Hallowell, Worcester, Mass. U.S. Pat. 1,197,622, Sept. 12, 1916. Date of appl., Mar. 10, 1915.

THE material is fed continuously into the upper part of a vertical chamber and is subjected to intermittent upward blasts of air introduced at the lower part of the chamber. The air separates the finer particles and carries them through an outlet situated above the lower end of the feed pipe, into a bag chamber which retains the solid particles.—W. H. C.

Filter, and filtering process. A. E. Krause, Jersey City, N.J. U.S. Pat. 1,198,039, Sept. 12, 1916. Date of appl., Aug. 26, 1914.

A COMPOSITE filter comprises a first section consisting of a layer of carbonaceous flue dust having an acid reaction and selective oil-removing properties, and a second section formed of serpentine asbestos which is capable of neutralising acid, and also has oil-removing properties.—W. H. C.

Filtering apparatus. O. J. Salisbury, Salt Lake City, Utah. U.S. Pat. 1,198,282, Sept. 12, 1916. Date of appl., Dec. 9, 1915.

THE filtering agent is enclosed in a casing formed of two similar sections suspended by hinges along the upper longitudinal joint so that they can be moved outwards in unison. The filtering agent is lowered while the sections are being opened and raised while they are being closed again.—W. H. C.

Evaporation of liquids giving off noxious gases. J. O. Lundberg, Flateby, Norway. U.S. Pat. 1,198,245, Sept. 12, 1916. Date of appl., July 31, 1915.

EVAPORATION is effected in several stages, in the first of which steam is the heating agent, while in the remainder the vapour from the preceding stage heats the liquid residue from the preceding

stage. The vapour from the last stage is utilised to evaporate water condensed from the steam used as heating agent in the first stage.—W. F. F.

Liquids; Method of treating — with gases. C. S. Bradley, New York. U.S. Pat. 1,198,519, Sept. 19, 1916. Date of appl., Dec. 18, 1913.

A LIQUID is treated with a gas, e.g., for oxidising, by running it into a vessel and bubbling gas through it at such a rate that only the foam overflows into a second vessel, where it is re-liquefied and treated again in the same way.—W. F. F.

Crushing mill; Vertical.—T. J. Sturtevant, Wellesley, Mass., Assignor to Sturtevant Mill Co. U.S. Pat. 1,198,597, Sept. 19, 1916. Date of appl., June 24, 1916.

In a vertical crushing mill, the step bearing of the vertical shaft is formed in a spider frame which is bolted by means of lugs to a flange on the base of the casing. The frame is adjusted in height by interposing washers of varying thickness. The shaft is driven by bevel gearing, and all parts except the shaft are removable through the bottom of the casing.—W. F. F.

[Nickel] catalysis; Process of regenerating.—N. Sulzberger, New York. U.S. Pat. 1,199,032, Sept. 19, 1916. Date of appl., Mar. 20, 1916.

A CATALYST containing nickel associated with silica is regenerated by dissolving the nickel in an acid and the silica in an alkali, mixing the solutions to precipitate nickel silicate, and reducing the precipitate to render it catalytically active.—W. F. F.

Evaporating apparatus. P. Kestner. Fr. Pat. 478,684, May 14, 1915. Under Int. Conv., May 16, 1914.

SEE Eng. Pat. 12,124 of 1914; this J., 1915, 823.

Catalysts. O. D. Lucas. Fr. Pat. 478,739, May 18, 1915.

SEE Eng. Pat. 5847 of 1914; this J., 1915, 784.

Combined apparatus for ventilating, steaming, fire extinguishing, gas-freeing, and sounding of tanks or vessels containing oil, petroleum spirit, or other inflammable liquids. Eng. Pat. 14,331. See IIa.

Apparatus for drying vapour, particularly in connection with benzol and other stills. Eng. Pat. 17,568. See III.

Evaporation of waste liquors, especially waste liquors from the sulphite- and sulphate-cellulose processes. Ger. Pat. 293,394. See V.

Condensers [for nitric acid]. Eng. Pat. 101,307. See VII.

Kilns. U.S. Pat. 1,199,015 and 1,199,016. See VIII.

Rotary vacuum-filler. U.S. Pat. 1,198,880. See X.

IIa.—FUEL; GAS; MINERAL OILS AND WAXES.

Dissolved acetylene; Committee on —.

THE HOME SECRETARY has appointed a Committee to consider the existing regulations in regard to cylinders of dissolved acetylene compressed into a porous substance, and to suggest amendments to these regulations where it appears desirable. The Committee consists of Major A. M. Cooper-Key, C.B. (Chairman), Eng.-Captain C. W. J. Bearblock, R.N., Prof. C. V. Boys, F.R.S., Major T. H. Crozier, Mr. W. S. Smith, and Dr. T. E. Stanton,

F.R.S. Major Crozier is to be the Secretary of the Committee, and all communications should be addressed to him at the Home Office.

Coal-dust explosions; Influence of incombustible substances on —. A. S. Blatchford. Trans. N. Eng. Inst. Min. and Mech. Eng., 1916, 46, 235—251.

THE author gives results of experimental work on the quenching effect of different substances. Explosions with different mixtures were carried out in a strong spherical glass vessel of a capacity of about 120 cubic inches. The impulse of the explosion acts on a pendulum, the stationary position of the latter indicating a quenched explosion. Average results of experiments on four coals are given below, the figures indicating the least percentage of material in a mixture which prevents an explosion. Glauber's salt (GfI_2O) 8, sodium bicarbonate 8, soda-crystals (SH_2O) 10, anhydrous sodium carbonate 12, magnesia alba 19, magnesia 28, gypsum 30, Chance mud 35, ground shale 40, quicklime 48, boiler-ashes 53. The author suggests that the liberation of carbon dioxide from a quenching material has but small influence on the explosive character of a mixture, and that the specific heat of the quenching substance may be an important factor in its efficiency. He states that the effect of a quenching material is probably due to the rate of heat-absorption over a particular range of temperature, and suggests that the explanation of the quenching action should be sought in the physical rather than in the chemical properties of the materials.—J. E. C.

Peat powder as locomotive fuel. Engineering, 1916, 102, 387.

PEAT powder was blown into the fire-box of a locomotive by compressed air, and ignited by a small coal fire. Heating values of peat powder and coal averaged 7920 B.Th.U. and 13,030 B.Th.U. respectively. The steam was superheated to a higher degree with peat powder than with coal, owing to the longer flame produced. Comparative tests showed an evaporation of 4.71 kilos. and 6.81 kilos. of water per kilo. of peat powder and coal respectively.—J. E. C.

Coal tar pitch; Transport of hot, fluid — in tank-wagons for briquette manufacture. Z. angew. Chem., 1916, 29, 549.

A BRIQUETTE factory at a Silesian colliery proposes to obtain a supply of pitch direct from a neighbouring coal-tar distillery in a fluid form transported in tank-wagons. The system has already been in operation at Bochum, where the wagons holding 15 tons are charged with pitch from the retorts at 250°C .; in this case the distance on rail is 4 km. and the time between filling and emptying 7 hours; the fluid pitch is readily discharged by compressed air. This system is intended to work in conjunction with the Fohr-Kleinschmidt method of briquetting. The pitch is heated to $130^\circ\text{--}170^\circ\text{C}$. to bring it to a mobile condition and then sprayed by a steam-heated atomiser, worked with steam or compressed air, into a mixing drum where the pitch spray solidifies whilst still in the air to an extremely fine soot-like dust. Under the slow rotation of the drum and the action of suitable elevating and transporting arrangements, an intimate mixture of the coal dust and binder is produced, which is then passed to a kneading apparatus with superheated steam and finally pressed into briquettes at $50^\circ\text{--}80^\circ\text{C}$. By this process the proportion of pitch in the briquettes is reduced by fully 1% (on an average percentage of 7) and the costs of manufacture are further decreased by the tank-wagon system of transport. The tank-wagons

can be emptied in 15 mins. and the necessity of handling, breaking, and melting the pitch is avoided.—J. F. B.

Blast-furnace gas; New application of — W. Zimmermann. *Stahl u. Eisen*, 1916, 36, 573—581, *Z. angew. Chem.*, 1916, 29, Ref., 415.

THE blast-furnace gas is introduced into coke-ovens above the coke; it reacts with the hot coke-oven gas yielding a gas containing less carbon dioxide and nitrogen and more light and heavy hydrocarbons, and hence possessing a higher calorific value, than the so-called mixed gas prepared by mixing together cold coke-oven gas and blast-furnace gas; the increase of calorific value amounts to from 8 to 13.6%. In addition the yield of ammonia is increased by about 25%, owing to the cooling effect produced in the coke-ovens by the introduction of blast-furnace gas. —A. S.

Petroleum; Action of aluminium chloride on — A. Pictet and I. Lerczynska. *Bull. Soc. Chim.*, 1916, 19, 326—334. (See also McAfee; this J., 1915, 1002.)

ANHYDROUS aluminium chloride dissolves in the higher fractions (b.p. above 140° C.) from petroleum to a brown solution, which on distillation yields as first fraction (b.p. 40°—140° C.) a product possessing all the properties of light petroleum spirit (benzene). A suitable amount of aluminium chloride is 10% of the weight of the petroleum. The yield of petroleum spirit depends only on the source of the petroleum (see table), and not on the rate of distillation or pressure, and the product is not altered by a further treatment with aluminium chloride. Calcium, zinc, chromium, copper, mercuric, and silicon chlorides are without action on petroleum; ferrous and ferric chloride have an incomplete action at a higher temperature. The petroleum spirit produced by the action of aluminium chloride is a colourless, non-fluorescent liquid (sp.gr. 0.72) with a pleasant ethereal odour; it consists of saturated hydrocarbons, and is free from chlorine and sulphur.

Fractions from treated product.

| | | 40°— 140° C. | 140°— 180° C. | 180°— 360° C. | Residue. |
|--------------------------------|----------|-----------------|------------------|------------------|----------|
| Illuminating oils. | Galician | 50 | 10 | 28—29 | 11—12 |
| | Austrian | 46.5 | 10 | 26.5 | 16 |
| | American | 30 | 20 | 35 | 12 |
| | Baku | 40 | 16 | 25 | 18 |
| Lubricating oils. | Austrian | 20 | 52 | 15 | 13 |
| | American | 17.5 | 22.5 | 34 | 25 |
| | Baku | 31.5 | 12 | 56 | |
| Vaseline | | 21.5 | 35 | 38.5 | |
| Paraffin (Galician) | | 35 | 13 | 52 | |
| Vacuum tar* (up to 200° C.) | | 15 | 30 | 55 | |

* See this J., 1913, 1098; 1914, 70; 1915, 163, 604.

—F. W. A.

Gasoline, unsaturated and aromatic hydrocarbons; Effect of aluminium chloride upon a naphthene base oil in the formation of — G. Egloff and R. J. Moore. *Met. and Chem. Eng.*, 1916, 15, 340—350.

A NAPHTHENE base oil, having a sp.gr. of 0.878 at 15.5° C. and an initial b.p. of 175° C., was fractionated by steam, direct, and vacuum distillation, and a series of six fractions obtained amounting together to about 28% by volume of the original oil; 300 c.c. of each fraction was placed, with 10% of its weight of aluminium chloride, in a 500 c.c. Kjeldahl flask having a

24 in. Liebig condenser attached, and maintained at below 100° C. for 12 hrs., during which time any newly-formed hydrocarbons boiling below this temperature were removed from the sphere of the reaction. The residue in the flask and the distillate recovered were treated separately with a 10% solution of sodium hydroxide, filtered, washed, and dried with calcium chloride, then mixed together and the volume of the converted oil determined. Each fraction of the series was also analysed, before and after conversion, by means of fractional distillation, sulphonation, nitration, and determination of sp.gr. and refractive index. For the latter purpose, fractionation was first effected in a 300 c.c. round-bottomed flask provided with a Glinzky still head, in which the fractions to 95°, 95°—120°, and 120°—150° C. (for benzene, toluene, and xylene, respectively) were thrice run; and then by simple distillation of the residue in a standard 200 c.c. Engler flask, from which fractions were collected at intervals of 25° C. until cracking of the residuum occurred. After treatment with aluminium chloride the six oils yielded from 24.3 to 60.2% of hydrocarbons boiling below the initial b.p.s. of the originals, the maximum conversion being effected in the oil of highest b.p.; the total oil recovered varied between, 60 and 79.3% of the original. In every case, the sp.gr. and refractive index of the recovered oil was lower than that of the starting oil, the greatest change being observed in the highest boiling oil, the sp.gr. of which was thus reduced from 0.849 to 0.774. The recovered oils yielded from 23.5 to 47.3% of gasoline (sp.gr. 0.726 to 0.801), equivalent to from 18.4 to 32.1% of the original oils, the maximum conversion being effected in the oil of highest b.p., which also yielded the gasoline of lowest sp.gr. The highest proportions of toluene and xylene were found in the oil recovered from the starting oil of lowest b.p., and that of benzene from the product of the next oil in the series; on the basis of the original oils, maxima of 1.11, 2.35, and 7.80% were obtained for benzene, toluene, and xylene, respectively. The percentages of unsaturated hydrocarbons and of hydrocarbons capable of being nitrated were usually higher in the original than in the converted oils for the same distillation cuts. The original oils contained large quantities of hydrocarbons capable of being nitrated, 54.9% being found in the distillation cut between 150° and 175° C. In every case the proportion of stable hydrocarbons remaining after sulphonation and nitration was greater in the converted than in the original oil.—W. E. F. P.

Naphthene base oil; Thermal and pressure decomposition of a — in the gas phase. G. Egloff, T. J. Twomey, and R. J. Moore. *Met. and Chem. Eng.*, 1916, 15, 387—393.

THE decomposition products, viz., gasoline, unsaturated compounds, benzene, toluene, and xylene, formed from two naphthene base oils at 550°, 600°, 650°, and 700° C., with pressures of one and eleven atmospheres, have been studied. Although similar as regards distillation and specific gravity, the two oils gave widely different percentage yields of the above products under the same conditions of temperature and pressure, the results emphasising the importance of the character of the starting oil used in cracking, when yields of certain hydrocarbons are desired in maximum quantity. Increase in temperature and pressure increased the decomposition and the specific gravity of the oils obtained, but at the same temperatures an increase of pressure to 11 atmospheres gave a lower percentage yield of recovered oil. The maximum percentages by volume of aromatic hydrocarbons were 14.1%, made up of benzene (2.6%), toluene (4.7%), and xylene (6.8%), at

650° C. and atmospheric pressure, and 18.2% made up of benzene (7.2%), toluene (5.0%), and xylene (5.1%), at 650° C. and eleven atmospheres. The maximum percentage yield of gasoline at 650° C. and atmospheric pressure was 19.3%, and at 800° C. and 11 atmospheres, 26.2%. Up to 150° C., the percentages of olefines and unsaturated compounds, in the gasoline cut, ranged between 8.6 and 42.3%, increase of pressure decreasing the formation. The percentage of oil decomposed—forming carbon and gas—increased with increase of temperature and pressure, varying from a minimum of 10% at 550° C. and 1 atmosphere to a maximum of 69.3% at 700° C. and 11 atmospheres.—B. N.

Natural asphalts; Chemical composition of—
J. Marcusson. Z. angew. Chem., 1916, 29, 346–348, 349–351.

The following method of analysis is a development of that devised by Richardson (this J., 1913, 646):—
Free acids:—Five grms. of the bitumen is dissolved in 25 c.c. of benzene, and the solution treated with 200 c.c. of neutral alcohol, which precipitates most of the neutral constituents. The solution is decanted and titrated with N/10 alcoholic sodium hydroxide solution, with phenolphthalein as indicator. It is then diluted with an equal volume of water, and unsaponified substances are extracted by shaking with benzene, after which it is evaporated on the water-bath and the acids liberated by means of a mineral acid. They consist of brown resinous masses, which are sparingly soluble in petroleum spirit, fairly soluble in benzene, and almost completely soluble in chloroform. *Acid anhydrides*:—The unsaponified portion is united to the pitch-like substances precipitated by alcohol from the original benzene solution, and saponified with N/1-alcoholic potassium hydroxide solution in presence of benzene, and the resulting acids are liberated as described above. *Asphaltenes*:—All constituents which have not reacted with alkali are dissolved in about 10 c.c. of benzene, and the solution poured into 200 c.c. of petroleum spirit boiling below 50° C. The precipitated dark brown powder is washed with petroleum spirit, dried, and weighed. *Unaltered oil*:—The petroleum spirit solution is concentrated to about 50 c.c., distributed on to about 25 grms. of fullers' earth in a Soxhlet thimble, and extracted with petroleum spirit. The extract is evaporated and leaves a light coloured residue resembling a viscous mineral oil. *Petroleum resins*:—These are retained by the fullers' earth, from which they are subsequently extracted by means of chloroform. The following results were thus obtained with bitumens:

| Bitumen from | Free asphaltogenic acids. | Inner anhydrides of acids. | Asphaltenes. | Petroleum resins. | Unaltered oily substances. |
|-------------------------------|---------------------------|----------------------------|--------------|-------------------|----------------------------|
| | % | % | % | % | % |
| Crude Trinidad asphalt | 6.4 | 3.9 | 37.0 | 23.0 | 31.0 |
| Refined Bermuda asphalt | 3.5 | 2.0 | 35.3 | 14.4 | 39.6 |

Formation and composition of asphalt constituents:—
(1) *Oily substances*:—These have a sp.gr. below 1, and show appreciable optical dextro-rotation. They consist, in the main, of a mixture of saturated and unsaturated hydrocarbons, and have iodine values similar to those of viscous mineral oils (e.g. 16.6 and 18.0, respectively, in the case of the oils from the Trinidad and Bermuda asphalts). They contain very little paraffin wax (usually less than 1%). (2) *Petroleum resins*:—These form the first stage in the conversion of petroleum

hydrocarbons into asphaltenes. They are solid reddish-brown to brownish-black masses which melt below 100° C. They are soluble in petroleum spirit, chloroform, carbon bisulphide, and benzene, but, unlike light machine oils, are only sparingly soluble in hot or cold acetone. Their sp.gr. approximates to 1. When treated with fuming nitric acid they are converted into light brown nitro-acids, which are dissolved as salts by alcoholic potassium hydroxide solution. Sulphuric acid at 100° C. converts them into insoluble sulpho-compounds, whilst sulphuric acid and formaldehyde react with them to form sparingly soluble precipitates. When oxidised with potassium permanganate in pyridine solution they form solid acids, which give characteristic alkali salts. The iodine value is higher than that of mineral oils (e.g., 33.7 in the case of the Trinidad asphalt resin). (3) *Asphaltenes*:—These may be formed by the action of oxygen or sulphur on petroleum resins, as well as by intra-molecular changes within the latter. When the resins are heated for some time at 120° C. they lose their solubility in petroleum spirit, become deep black, and are converted into asphaltenes. The sp.gr. of asphaltenes exceeds 1. They are nearly insoluble in alcohol and petroleum spirit and sparingly soluble in ether and acetone, but are completely soluble in benzene, chloroform, and carbon bisulphide. They are characterised by their high proportion of sulphur (e.g. 7 to 13%) in a form sensitive to light, under the influence of which the asphaltenes are converted into an insoluble modification. Their behaviour towards nitric and sulphuric acids, etc., is nearly the same as that of the resins, but they are less readily oxidised by potassium permanganate. They have high iodine values (e.g., 40.2 and 27.8 in the case of the asphaltenes from Trinidad and Bermuda asphalts respectively). Nearly the whole of the halogen combines by addition and not by substitution. They contain considerable quantities of sulphides, and it is to these that the absorption of bromine and iodine is to be attributed. The asphaltenes and their parent resins appear to be saturated polycyclic compounds, which also contain sulphur or oxygen, either of which can replace the other. (4) *Asphaltogenic acids and their anhydrides*:—These acids are tar-like or resinous masses which are soluble in alcohol or chloroform, but are nearly insoluble in petroleum spirit. Their sp.gr. exceeds 1. They contain variable quantities of sulphur. Their sodium salts are sparingly soluble. When heated they are converted into anhydrides. The acids from Trinidad crude asphalt gave the following results, which are compared with those given by the acids obtained by heating Texas oil in the air:—

| Acids from: | Solubility in petroleum spirit. | Acid value. | Saponification value. | Iodine value. | Sulphur. |
|------------------------------|---------------------------------|-------------|-----------------------|---------------|----------|
| Trinidad crude asphalt | nearly insol. | 98.5 | 120.4 | 22.4 | 3.1 |
| Texas oil | nearly insol. | 89.3 | 147.0 | 17.3 | 1.2 |

(See also this J., 1911, 430; 1914, 739).—C. A. M.

Asphalt industry; Standards for products of the—
J. Marcusson. Mitt. K. Materialprüf., 1916, 34, 40–55.

By means of the analytical methods worked out by the author and others (this J., 1912, 63; 1913, 188, 223; 1914, 739; 1915, 1235) it is now possible to distinguish natural from artificial asphalts, to identify the various kinds of asphalts in mixtures,

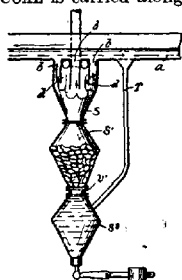
and, in many cases, to determine quantitatively natural asphalts in admixture with artificial products. As a preliminary to the establishment of standards for the products of the asphalt industry, the author gives a brief critical review of the specifications adopted by a number of municipal and other authorities and private consumers for various asphalt products. For the raw paper for the manufacture of roofing felt, the following standards have been fixed by the *Materialprüfungsamt* in conjunction with the *Verband deutscher Dachpappenfabriken*. (1) For the preparation of the paper, rags, fibrous textile waste, and waste paper may be used, but direct addition of wood pulp, straw pulp, peat, sawdust, and mineral loading materials is forbidden. (2) The paper must not yield more than 12% of ash. (3) Moisture content of air-dry paper must not exceed 12%. (4) Paper which when immersed in anthracene oil absorbs less than 120% must be considered unsatisfactory. (5) Paper of normal thickness (at least 400 grms. per sq. m.) must have a breaking weight (for a strip 15 mm. wide) in the longitudinal direction of at least 3 kilos.—A. S.

Heat treatment of brass in neutral and reducing atmospheres. Use of coal gas. White and Standerine. See X.

PATENTS.

Coal and other minerals; Apparatus for washing — P. Habets, Montegnée, and A. France, Liege, Belgium. U.S. Pat. 1,197,932, Sept. 12, 1916. Date of appl., Feb. 9, 1914.

COAL is carried along a horizontal channel, *a*, by a stream of water and falls through slots into vertical passages, *b*, in a washing chamber, *s*. Water from an independent supply enters by other passages, *d*, and circulates upwards through the passages, *b*. Mineral matter collects in the chamber, *s*, which is provided with a valve, *v*¹, communicating with a trap, *s*², which is connected by a pipe, *T*, with the channel, *a*.—W. F. F.



Coal, ore, etc.; Apparatus for separating — F. Pardee, Hazleton, Pa. U.S. Pat. 1,197,946, Sept. 12, 1916. Date of appl., May 2, 1913.

WATER enters tangentially into the top of a separating vessel of inverted conical shape. The heavier material passes through an outlet at the bottom into a receiving and settling chamber, while the lighter material is withdrawn upwards by suction through a vertical pipe extending nearly to the bottom of the separating vessel. Water is separated from the solid material in both cases and returned to the separating chamber.—W. F. F.

Pitch; Utilisation of — as a fuel. G. H. H. Bölling, Christiania. Eng. Pat. 101,444, Apr. 5, 1916. (Appl. No. 5029 of 1916.) Under Int. Conv., Mar. 25, 1916.

PITCH is melted by means of a steam coil and introduced, through heated pipes, into the furnace where it is atomised by a jet of steam or air. The steam jackets, pipes, and valves are arranged so that any incrustation can be removed.—J. E. C.

Coal and the like; Presses for agglomerating — H. Steven, Gilly, Belgium. Eng. Pat. 2500, Jan. 30, 1914. Under Int. Conv., Jan. 31, 1913.

IN a modification of the moulding press described in Eng. Pat. 228 of 1914 (see Fr. Pat. 466,420;

this J., 1914, 635) in which the material is subjected to four successive compressions in the same mould carried by a rotary mould table, the first and last compressions are effected by cams or the like, and the second and third by hydraulic presses. The cams are carried by one shaft and the mould plate and hydraulic control valves are operated by another shaft, both shafts being driven simultaneously from the same source. Means are provided for compensating for leakage of liquid in the hydraulic system at the end of each backward stroke of the hydraulic pistons.—W. F. F.

Briquettes of anthracite, coke, lignite, [wood charcoal,] etc.; Manufacture of smokeless — A. Exbrayat. Second Addition, dated June 20, 1914, to Fr. Pat. 470,949, June 28, 1913 (this J., 1915, 215; 1916, 33).

IN the manufacture of briquettes such as those described in the principal patent and first addition thereto, the caustic soda and silicates of aluminum and calcium are replaced by hydraulic lime.

—W. F. F.

Paper or other organic material; Process and apparatus for making briquettes from — A. Specken. Fr. Pat. 479,162, Apr. 3, 1915. Under Int. Conv. (in the name of F. Isler), Oct. 19, 1914.

THE apparatus consists of a vat above which is mounted a cylindrical envelope containing a perforated cylinder fitting loosely therein and a piston capable of being pressed into the cylinder by means of an overhead lever. The paper is worked up into a pulp with water in the vat and mixed with other waste materials such as charcoal, wood waste, or rags; the pulp is charged into the perforated cylinder and pressed into a briquette while the water drains back into the vat.—J. F. B.

Chequer bricks used in the chequering chambers of carburetted water-gas plants or coke-oven chambers. E. J. Davison, London, and C. P. Tooley, Leeds. Eng. Pat. 16,634, Nov. 25, 1915. (See also Eng. Pat. 745 of 1915; this J., 1916, 297.)

CHEQUER bricks are designed with alternate square pedestals and fine-edged bevelled recesses on their upper and lower surfaces; the pedestals on the upper surface are opposite to recesses on the lower surface. The bevel may be flat, convex, or concave.—J. E. C.

Coke ovens; Regenerative — British Coke Ovens, Ltd., and F. M. N. Schuster, London. Eng. Pat. 101,394, May 5, 1916. (Appl. No. 6512 of 1916.)

THE bricks in the regenerator chamber are composed of a base portion with two parallel upstanding flanges spaced from the edges and from one another. The bricks are placed in layers slightly shorter than the width of the chamber, so that the bottom layer has one edge in contact with the side wall and each layer is slightly displaced relatively to the one below till the opposite wall is reached. The displacement of the next layers is in the opposite direction till the first wall is reached and so on. The gases are thus constrained to pass horizontally through a series of flues and then in the reverse direction through another series of flues and so on.—W. F. F.

Coke-ovens; Device for leading away noxious gases during the charging of — H. Koppers, Essen. Ger. Pat. 294,000, Apr. 10, 1915. Addition to Ger. Pat. 291,053 (this J., 1916, 683).

GROOVES are formed in the walls of the oven just below the charging opening, so that annular channels are left open around the heaps of coal of sufficient size to accommodate the gas evolved during the charging operation and allow it to pass freely to the gas-outlet pipe.—A. S.

Gas manufacture; Automatic control of processes of — J. F. Simmance, London. Eng. Pat. 13,292, Sept. 17, 1915.

THE invention comprises an apparatus for the automatic control of gas manufacture, consisting of a combination of a recording instrument indicating the variation of some physical property of the gas produced, with means whereby the governor valve is controlled by the travel of the pen or indicating part of the instrument.—J. E. C.

Coal; Method of carbonising — H. L. Doherty, New York. U.S. Pat. 1,197,804, Sept. 12, 1916. Date of appl., Mar. 21, 1913. Renewed Mar. 11, 1916.

COAL is moved downwards through a long vertical conduit, and preheated air is passed intermittently across it horizontally at its middle portion to maintain combustion at that point. Gas is withdrawn at the top, and part of it is burnt to preheat the air and part is admitted at the bottom of the fuel conduit and passed upwards. This gas is heated at the middle portion and thus preheats the descending fuel above, while the gas itself together with the distillation gas is cooled and withdrawn at the top.—W. F. F.

Gas producer. J. A. Herrick, Newark, N.J. U.S. Pat. 1,197,625, Sept. 12, 1916. Date of appl., Dec. 30, 1912.

AN interior lining to a gas producer is supported by a ring in segments connected to the casing. The segments are hollow, with openings to the exterior of the casing, and a poker tube is attached to one of the segments.—J. E. C.

Gas producer. G. B. Cramp, Duluth, Minn., Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,198,010, Sept. 12, 1916. Date of appl., Jan. 10, 1914.

IN a gas producer with a rotating ash support, automatic means are provided for delivering ashes at predetermined intervals and for varying the duration of such intervals.—J. E. C.

Gas producer. E. A. W. Jefferies, Assignor to Morgan Construction Co., Worcester, Mass. U.S. Pat. 1,198,037, Sept. 12, 1916. Date of appl., Aug. 6, 1913.

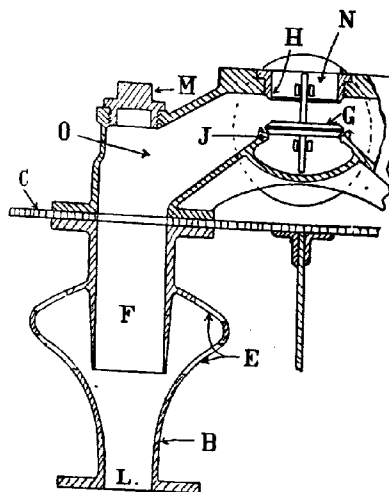
A gas producer is provided with a rotating ash support and a scraper which may be allowed to revolve with the ash support or held stationary by a stop.—J. E. C.

Gas generators; Regulation of air-blast in — C. H. Smoot, South Orange, N.J., Assignor to The Rateau Battu Smoot Co., New York. U.S. Pat. 1,198,162, Sept. 12, 1916. Date of appl., Oct. 19, 1915.

IN a gas generating apparatus consisting of a generator and carburettor, a constant volume of air, at desired pressure, is delivered to the generator, regardless of the amount of air delivered to the carburettor. The volume is regulated by means of the difference in pressure in the air-delivery pipe proper and at the throat of a Venturi meter fitted in the delivery pipe.—J. E. C.

Tanks or vessels containing oil, petroleum spirit, or other inflammable liquids; Combined apparatus for ventilating, steaming, fire-extinguishing, gas-freeing and sounding of — T. A. Crompton, Ilford, Essex. Eng. Pat. 14,331, Oct. 11, 1915.

THE apparatus is fitted to the cover, C, of the tank as shown, and an extension pipe is fitted to the opening, L. Gas given off from the liquid, or displaced in filling, passes through the openings, E, nozzle, F, pipe, O, and outlet, N. Air may enter in the reverse direction. The valve, G, is provided with two seatings, H, J, and rests normally



on the lower seating by gravity. The tank may be steamed out when empty by admitting steam to the space below the valve, G, so as to raise it against the seating, H. For fire-extinguishing in the gas space, the steam circulates through the opening, E, the extension pipe from the opening, L, being sealed by the liquid. Soundings may be taken by unscrewing the plug, M. The part, B, F, may be used separately as a ventilating and gas-freeing apparatus.—W. F. F.

Light hydrocarbons; Manufacture of — from heavy hydrocarbons. W. F. Rittman, New York. Eng. Pat. 9162, June 22, 1915. Under Int. Conv., Mar. 15, 1915.

HEAVY hydrocarbons such as crude mineral oils, oil residues or their products, or liquid hydrocarbons obtained from shale, are supplied from a reservoir to the top of a vertical cylinder. The upper part of the cylinder contains refractory material such as metal balls carried on a perforated shelf. The oil is suddenly gasified and the gas passes to the lower cracking portion of the cylinder which is heated by passing an electric current through a surrounding coil. The temperature and pressure are maintained above 450° C. and 100 lb. per sq. in. respectively. The lighter hydrocarbons boiling below 30° C. tend to separate upwards and the heavier hydrocarbons downwards by gravity. The latter pass by an outlet at the bottom of the cracking chamber to a fractional condenser. (See also this J., 1916, 1003.)—W. F. F.

Hydrocarbons; Cracking of — G. P. Lewis, London. Eng. Pats. 12,188, Aug. 24, 1915, and 2509, Feb. 19, 1916.

OIL is heated in the lower part of a vertical cylindrical apparatus by an external steam or hot gas jacket and the vapour passes upwards into the cracking chamber which contains a set of baffle-plates and is heated externally by a steam or hot gas jacket, or internally by heating coils. The temperature of the heating medium varies from 400° C. to 500° C. and the pressure of the oil gas from 60—280 lb. per sq. in. The cracked vapour passes upwards to a tubular condenser cooled by water at about 150° C. The temperature of the water may be varied by a pressure control valve. The baffle-plates may be replaced by fragments of solid material which may be catalytic or impreg

nated with catalytic material. The uncondensed gases or hydrogen or both may be re-introduced into the cracking chamber.—W. F. F.

Heavy oils, especially kerosene; Treatment of— for their conversion into lighter oils. M. A. H. de Dampierre. Fr. Pat. 478,831, Feb. 22, 1915. Under Int. Conv., Apr. 16, 1914.

HEAVY oils such as crude petroleum, kerosene, or petroleum residues, are vaporised, mixed with hydrogen, and passed through a tube containing a number of perforated nickel discs which act catalytically, and preferably also lined with nickel. The tube is cooled by water jackets, so that heavy oil is condensed and returned to the vaporising chamber, whilst the lighter vapour passes on to another condenser.—W. F. F.

Petroleum; Method of distilling—. Standard Oil Co. Fr. Pat. 477,829, Feb. 27, 1915. Under Int. Conv., Apr. 20, 1914.

PETROLEUM or petroleum residuum is circulated by a pump in a closed circuit, from the bottom of a partly filled reservoir through a heated coil of small bore to the top of the reservoir. The vapour formed passes by another pipe from the top of the reservoir to a water-cooled condensing coil and thence to a receptacle. The pressure maintained in the system varies from 3 to 7 atmospheres, and the temperature from 340° C. to 450° C.—W. F. F.

Alcohol [and hydrocarbons]; Adapting— for use with petrol motors. L. Rivière. First Addition, dated July 1, 1914, to Fr. Pat. 475,938, Mar. 20, 1914.

THE calorific value of alcohol, its derivatives, and hydrocarbons such as benzol, is increased, and the fuel rendered suitable for use with internal combustion engines, by hydrogenation in contact with a catalyst such as reduced nickel. The process may be carried out in the apparatus described in Fr. Pat. 374,179 and the second Addition thereto (this J., 1907, 769; 1909, 317).—W. F. F.

Briquettes or agglomerated fuel; Manufacture of—. Pure Coal Briquettes, Ltd. Fr. Pat. 478,872, June 1, 1915. Under Int. Conv., Oct. 7, 1914.

SEE Eng. Pat. 5018 of 1915; this J., 1916, 826.

Agglomerating process. [Manufacture of briquettes.] Pure Coal Briquettes, Ltd. Fr. Pat. 478,873, June 1, 1915. Under Int. Conv., Mar. 27, 1915.

SEE Eng. Pat. 5019 of 1915; this J., 1916, 592.

Fuel. Pure Coal Briquettes, Ltd. Fr. Pat. 478,874, June 1, 1915. Under Int. Conv., Mar. 27, 1915.

SEE Eng. Pat. 20,679 of 1914; this J., 1916, 297.

Coal gas plants; Method of operating—. A. E. White, London. From Riter-Conley Manufacturing Co., Leetsdale, Pa., U.S.A. Eng. Pat. 16,269, Nov. 18, 1915.

SEE U.S. Pat. 1,166,183 of 1915; this J., 1916, 245.

Carburized hydrogen; Apparatus and process for the manufacture of—. B. Van Steenberghe. Fr. Pat. 479,277, July 15, 1915.

SEE U.S. Pat. 1,124,364 of 1915; this J., 1915, 216.

Light hydrocarbons and analogous substances; Manufacture of—. Synthetic Hydro-Carbon Co. Fr. Pat. 479,210, July 6, 1915. Under Int. Conv., Mar. 15, 1915.

SEE Eng. Pat. 9162 of 1915; preceding.

Structure for producing flameless catalytic combustion. U.S. Pat. 1,198,542. See IIb.

Manufacture of benzene, toluene, and other aromatic hydrocarbons from petroleum and other hydrocarbons. Eng. Pat. 9163. See III.

IIb.—DESTRUCTIVE DISTILLATION; HEATING; LIGHTING.

PATENTS.

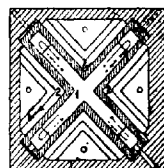
Coal and other hydrocarbons; Apparatus for treating—. J. D. Scott, Detroit, Mich. U.S. Pat. 1,198,069, Sept. 12, 1916. Date of appl., Oct. 23, 1914.

THE invention consists of a combination of a preliminary heating chamber, a vapour extracting chamber, and a cooling chamber, communicating with each other by sliding doors, and containing movable tray carriers.—J. E. C.

Wood; Apparatus for treating—. W. M. Bashlin, Grove City, Pa. U.S. Pat. 1,198,000, Sept. 19, 1916. Date of appl., Mar. 29, 1912.

A RETORT for treating wood is heated externally by a steam jacket, and internally by a dry-steam coil. Perforated pipes are grouped around the coil for the distribution of steam or solvents.—J. E. C.

Carbonising furnace. E. Ziegler, Berlin. Ger. Pat. 294,015, Nov. 6, 1915.



IN a vertical furnace with several carbonising chambers, for obtaining tar, gas, and coke from carbonaceous substances, the heating flues, 1, and the carbonising chambers, 2, have the form shown, in cross-section, in the figure.—A. S.

Combustion; Structure for producing flameless catalytic—. C. K. Harding, Chicago, Ill. U.S. Pat. 1,198,542, Sept. 19, 1916. Date of appl., Mar. 18, 1912.

A SUBSTANCE for producing heat from gaseous fuels by catalytic combustion consists of a structure containing thorium oxide and radioactive uranium oxide.—J. E. C.

Flameless surface combustion of combustible gas; Process and apparatus for the—. A. Adam. Fr. Pat. 477,958, July 9, 1914.

THE porous material within which combustion takes place has two of its faces at right angles in communication with the gas and air conduits respectively, so that mixing takes place within the material only and lighting back is avoided. A layer of rare earth may be applied to or embedded in the face of the porous material for illuminating purposes. The invention may be applied to gas burners of the ordinary type, a diaphragm of porous material being placed in a mixing chamber at the junction of the gas and air pipes to prevent lighting back.—W. F. F.

Vapour electric apparatus [producing ultra-violet rays.] P. C. Hewitt, Ringwood Manor, N.J. Assignor to Cooper Hewitt Electric Co., Hoboken, N.J. U.S. Pat. 1,197,629, Sept. 12, 1916. Date of appl., Sept. 19, 1912.

AN apparatus for the production of ultra-violet rays is composed of an exhausted vessel containing an anode and a thallium cathode. Means are provided for starting the current and producing thallium vapour, the current then passing through the vapour from anode to cathode.—B. N.

Bituminous fuels; Process and apparatus for manufacture of various products from —. R. Maclaurin. Fr. Pat. 479,110, June 25, 1915. Under Int. Conv., Oct. 28, 1913.

SEE Eng. Pat. 24,426 of 1913; this J., 1914, 1148.

Process of forming methyl alcohol and other compounds from waste [soda wood pulp] liquors containing organic matter. U.S. Pat. 1,197,983. See V.

III.—TAR AND TAR PRODUCTS.

Coal tar products; Census of —.

ON Nov. 1st the Ministry of Munitions announced that all persons engaged in the production, manufacture, purchase, sale, or distribution of any coal-tar or coke or their by-products (including in particular tar, carbolic crystals, benzol, toluol, ammoniacal liquor, and sulphate of ammonia) are required to furnish him with such particulars as to output, working of plant, cost of manufacture, sales, deliveries, stock in hand, purchases, and prices, at such intervals as may be required. Any particulars so furnished shall be verified and authenticated by the signature of the person required to furnish them, or, in the case of a company, by a responsible officer.

Transport of hot fluid coal tar pitch in tank-wagons for briquette manufacture. See IIa.

Effect of aluminium chloride upon a naphthene base oil in the formation of gasoline, unsaturated and aromatic hydrocarbons. Egloff and Moore. See IIa.

Thermal and pressure decomposition of a naphthene base oil in the gas phase. Egloff and others. See IIa.

Nitration of diethylbenzylamine. Noelting and Kregczy. See IV.

A modified chlorination process. [Preparation of chloro-derivatives of benzene.] Smythe. See XX.

PATENTS.

Benzene, toluene, and other aromatic hydrocarbons; Manufacture of — from petroleum and other hydrocarbons. W. F. Rittman. New York. Eng. Pat. 9163, June 22, 1915. Under Int. Conv., Mar. 15, 1915.

HYDROCARBON oils are subjected to a temperature at which a sudden gasification occurs, and whilst in the gaseous condition are cracked at a temperature not less than 600° C., preferably 650°—800° C., and a pressure not less than 60 lb. per sq. in., preferably 250 lb. per sq. in.—J. E. C.

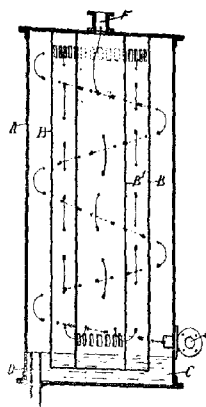
Xylene and other aromatic hydrocarbons; Treatment of — to obtain lower hydrocarbons of the same series. Synthetic Hydro-Carbon Co. Fr. Pat. 479,786, Sept. 20, 1915. Under Int. Conv., July 7, 1915.

XYLENE or other hydrocarbon is subjected, in the form of vapour, to a temperature not below 500° C. and a pressure not exceeding 200 lb. per sq. in. With higher temperatures (between 600° C. and 850° C.) a lower pressure, capable of being reduced to half an atmosphere, may be used. Under the latter conditions 30% of toluene has been produced from xylene.—J. E. C.

Benzene, toluene, and other aromatic and analogous hydrocarbons; Manufacture of —. Synthetic Hydro-Carbon Co. Fr. Pat. 479,211, July 6, 1915. Under Int. Conv., Mar. 15, 1915.

SEE Eng. Pat. 9163 of 1915; preceding.

Benzol and other stills; Apparatus for drying vapour, particularly in connection with —. J. E. Mitchell and H. Morley, Barnsley. Eng. Pat. 17,568, Dec. 16, 1915.



AN apparatus for separating suspended particles of liquid from benzol and other vapours comprises a vessel, A, having a tangential inlet, E, with one or more concentric baffle-tubes, B, B', and a central outlet, F. The lower ends of the baffle-tubes are sealed at C in liquid to a depth controlled by an overflow pipe, D.—J. E. C.

Utilisation of pitch as fuel. Eng. Pat. 101,444. See IIa.

Fire- and water-proof composition and process of making same. U.S. Pat. 1,194,558. See IX.

Preparation of chlorine derivatives of organic substances. Fr. Pat. 479,645. See XX.

Nitration process. U.S. Pat. 1,198,129. See XXII.

IV.—COLOURING MATTERS AND DYES.

Diethylbenzylamine; Nitration of —. E. Noelting and A. Kregczy. Bull. Soc. Chim., 1916, 19, 335—338.

NITRATION of diethylbenzylamine in sulphuric acid solution gives a mixture containing 35—40% of the *meta*-derivative (b.pt. 203°—208° C. at 42 mm.), 40—45% of the *para*-derivative (b.pt. 219°—221° C. at 12 mm.), and 15—20% of the *ortho*-derivative (b.pt. 175°—177° C. at 42 mm.). The isomerides may be separated by fractional crystallisation of their picrates from alcohol.—F. W. A.

Aminodiethylbenzylamines; Dyestuffs from —. E. Noelting and A. Kregczy. Bull. Soc. Chim., 1916, 19, 338—341.

AMINODIETHYLBENZYLAMINES are prepared by the reduction of the corresponding nitro-compounds (see above) with zinc or iron in acetic acid solution, and are colourless oils having the following b.pts. at 42 mm.: *ortho*, 153°—155° C.; *meta*, 167°—168° C.; *para*, 165°—166° C. On treatment with picryl chloride, the isomerides behave as substituted toluidines, and yield picryl derivatives, which, in addition to the acid properties of the products from toluidines, possess basic properties due to the substituent, and hence may be dyed on tanned cotton. Whereas the tolylated rhodamine from fluorescein chloride and toluidine is insoluble in water, the amino-alkylated derivative obtained by using aminodiethylbenzylamine is sufficiently soluble for dyeing silk, wool, and tannin-mordanted cotton, producing a redder shade of violet than the corresponding product from toluidine.—F. W. A.

Aminophenylarsinic acid; Dyestuffs from—
E. Noetting. Bull. Soc. Chim., 1916, 19, 341—343.

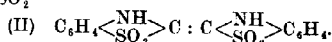
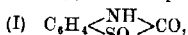
Azo dyestuffs derived from *p*-aminophenylarsinic acid and β -naphthol, its sulphonic acids, etc., may be dyed on mordants, *e.g.* chromium, iron, aluminium, titanium, tin, etc., giving yellow-orange, orange-red, red, to brown-red shades. Unmordanted wool gives yellow-orange to orange-red shades, browner dyeings resulting with chromed wool. The dyestuffs from *p*-aminophenylarsinic acid do not differ in shade from those of sulphanic and *p*-aminobenzoic acid, but their affinity for mordants is much greater.—F. W. A.

1,3-Dibromoanthraquinone. F. Ullmann and O. Eiser. Ber., 1916, 49, 2154—2169.

1,3-DIBROMOANTHRAQUINONE (m.pt. 210° C.) is obtained by removal of the amino-group from dibromo-1- or 2-aminoanthraquinone, preferably the latter. The bromine atom in the 1-position is readily replaced, *e.g.*, on boiling with aniline 3-bromo-1-anilinoanthraquinone is obtained, and on treatment with *p*-toluenesulphamide in amyl alcohol solution 3-bromo-1-*p*-toluenesulphaminoanthraquinone is produced, which gives 3-bromo-1-aminoanthraquinone (m.pt. 243° C.) on treatment with concentrated sulphuric acid. Anthranilic acid behaves similarly, giving 3-bromo-1-anthraquinonylanthranilic acid; this is readily converted into the corresponding acridone, which dyes bluer shades than the anthraquinoneacridone of Ullmann and Oechsner (Annalen, 1911, 381, 1); the shade becomes redder and the affinity for the fibre greater on introducing another bromine atom. Both bromine atoms are replaceable at higher temperatures, *e.g.* potassium phenoxide gives 1,3-diphenoxyanthraquinone, and 1-aminoanthraquinone gives α,α' -dianthraquinonyl-1,3-diaminoanthraquinone. 1,3-Dibromo-2-aminoanthraquinone gives with *p*-tolylmercaptan 3-bromo-2-amino-1-anthraquinonyl-*p*-thiocresol. The bromine atom in 4-position is most active in 2,4-dibromo-1-aminoanthraquinone; on heating with aniline the 4-bromine atom is eliminated, giving 2-bromo-1-aminoanthraquinone.—F. W. A.

Sulphurylindigo and sulphurylisatin. Heterocyclic sulphones. V. M. Claass. Ber., 1916, 49, 1880—1883. (Compare this J., 1916, 960.)

THE action of nitrous acid on sulphurylindoxyl (compare this J., 1916, 529) gives a 20% yield of a dinitrile and not an oxime. The main reaction taking place is the oxidation of the methylene group, resulting in the production of sulphurylisatin (I), and sulphurylindigo (II),



If the reaction is carried out in an anhydrous medium, *e.g.* by passing nitrous acid into a warm benzene solution of sulphurylindoxyl, a 60% yield of pure sulphurylindigo is produced. In order to obtain the isatin, it is preferable to add nitrosulphurylindoxyl to 5% caustic soda solution, when a vigorous reaction occurs, the isatin afterwards being precipitated by addition of an acid; it is a brown powder, of m.pt. 150°—155° C., soluble in ammonia, sodium carbonate, and caustic soda solution, and readily soluble in alcohol and in acetic acid. Chromic acid in glacial acetic acid is a suitable oxidising agent for preparing sulphurylindigo; the indigo is obtained as a microcrystalline brown powder of m.pt. 106°—110° C., readily soluble in alcohol and in acetic acid, insoluble in water and in alkalis, which however decompose it on heating; it does not dye animal or vegetable fibres; hydrosulphite is without action on it. Oxidation of 2-bromo-

sulphurylindoxyl with chromic acid gives α,α' -dibromosulphurylindigo (m.pt. 142°—143° C.).
—F. W. A.

PATENTS.

Anthracene dyestuffs; Manufacture of—[Adapted *Pyrazole-anthrone Yellow*.] A. G. Bloxam, London. From Chem. Fabr. Griesheim-Elektron, Frankfurt, Germany. Eng. Pat. 14,103, Oct. 5, 1915.

PYRAZOLE-ANTHRONE Yellow (see Ger. Pat. 255,641; this J., 1913, 357) or a substitution product in the form of an alkali salt is treated with an alkylating or aralkylating agent. *Example*: One part of Pyrazole-anthrone Yellow, in the form of paste, is digested with 50% caustic potash solution until completely converted into the violet potassium salt, the solution diluted until it contains 3—5% caustic potash, and the salt drained as much as possible; the paste obtained is heated with one or two parts of benzyl chloride in a closed vessel at 100° C. for 3 hrs., and the product is diluted with alcohol, filtered, and the residue washed with alcohol. The mono-benzyl derivative produced gives with hydrosulphite a blue vat from which cotton is dyed scarlet shades. On heating 38 parts of the benzyl derivative, in the form of the dried potassium salt, with 120 parts of the methyl ester of toluene-*p*-sulphonic acid in an autoclave for 1 hr. at 120° C., with stirring, the benzylmethyl derivative is obtained; this product dyes cotton an excellent fast red.—F. W. A.

Acid wool [azo] dyestuffs indifferent to copper; Manufacture of—O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 15,127, Oct. 26, 1915. Addition to Eng. Pat. 1611, Feb. 1, 1915.

THE copper compounds of the dyestuffs described in Eng. Pats. 1611 (this J., 1916, 301) and 12,219 of 1915 (this J., 1916, 922) are obtained direct by combining the *o*-diazophenol or naphthol derivative with a suitable component in presence of copper or a copper compound. The combination generally occurs more readily under these conditions. *Example*: 24 grms. of copper sulphate crystals and 60 grms. of water are added with stirring to a concentrated solution of 25 grms. of 1,5-naphtholsulphonic acid sodium salt and 40 grms. of calcined sodium carbonate; the diazo compound from 24 grms. of 1,2,4-aminonaphtholsulphonic acid is added with stirring, the mixture is stirred for 24 hrs. at the ordinary temperature, and then heated gradually to 40° C. and maintained at that temperature until combination is complete; the excess of copper hydroxide is filtered off, and the copper compound salted out. The product dyes wool from an acid bath pure violet tints fast to light, washing, and alkali. Whereas an extremely small yield is obtained by combining 1,2,4-aminonaphtholsulphonic acid with 1,5-naphtholsulphonic acid by the usual methods, an approximately quantitative yield of the copper compound of the *o*-hydroxyazo dyestuff is obtained by the above method.—F. W. A.

***o*-Hydroxyazo dyestuffs; Manufacture of direct**—O. Imray, London. From Soc. Chem. Ind. in Basle, Switzerland. Eng. Pat. 101,601, Aug. 25, 1915. (Appl. No. 6871 of 1916.)

IN the manufacture of direct *o*-hydroxyazo dyestuffs as described in Eng. Pat. 12,250 of 1915 (this J., 1916, 1008), at least one molecule of an *o*-hydroxydiaz derivative of the benzene or naphthalene series is substituted for the diazotised monoamine in preparing substantive tris- and polyazo dyestuffs from tetrazotised *p*- and *m*-diamines, suitable components, and diazotised monoamines. The most valuable dyestuffs are

obtained by using 2-amino-5-naphthol-7-sulphonic or -1,7-disulphonic acids or their derivatives. In case the diamine is used together with a derivative of *o*-aminophenol or naphthol and a derivative of 2-amino-5-naphthol-7-sulphonic acid, in addition to benzidine, tolidine, dianisidine, ethoxybenzidine, *p*-diaminostilbene-disulphonic acid and their substitution products, there may be used diaminodiphenyl ether, diaminodiphenylamine, *m*- or *p*-aminobenzoyl-*m*- or *p*-phenylenediamine, azoxyaniline, azoxytoluidine, *m*- or *p*-diaminodiphenylurea, or diaminodiphenylthiourea. In place of diazophenol derivatives the more easily coupling diazoacidylphenol derivatives may be used, the products being subsequently saponified. The new dyestuffs are suitable for dyeing cotton, wool, silk, straw, wood, paper, leather, etc., and for the production of lake pigments. (Reference is directed, in pursuance of Sect. 7, Sub-sect. 4, of the Patents and Designs Act of 1907, to Eng. Pat. 15,056 of 1892; this J., 1893, 753.)—F. W. A.

Indophenolic compounds and dyestuffs therefrom; Manufacture of—Claus and Co., Ltd., and E. Wray, Manchester. Eng. Pat. 101,433, Jan. 27, 1916. (Appl. No. 1317 of 1916.)

CARBAZYL-N-ACETIC acid or its esters, obtained by condensing carbazole or an alkaline salt thereof with chloroacetic acid or ester, condenses with *p*-nitrosophenol, etc., in sulphuric acid medium to give indophenols. On treatment with sulphurising agents these indophenols or their leuco-compounds yield dyestuffs which give blue dyeings on cotton, fast to washing, light, and bleaching, from a sulphide or hydrosulphite vat.—F. W. A.

V.—FIBRES; TEXTILES; CELLULOSE; PAPER.

Filter paper with fine pores. J. Grossfeld. Z. angew. Chem., 1916, 29, 364.

A FILTER paper capable of retaining the finest precipitate of barium sulphate, etc., has its pores filled with purified kieselguhr (nearly pure silica). On igniting the paper, the mineral matter is left as a coherent pellicle.—C. A. M.

Paper specialties; Use of bark for—O. Kress. J. Ind. Eng. Chem., 1916, 8, 883—886.

EXPERIMENTS have been made in the U.S. Forest Products Laboratory on the utilisation of spent bark and other waste bark as a filler in the manufacture of various paper products. Satisfactory results have been obtained on a commercial scale with mixtures of 29–30% of spent hemlock bark and 70–80% of rag stock for the manufacture of roofing felt. The wet bark (35% of dry substance) is passed through a screen of $\frac{1}{2}$ in. mesh into a chest from which it is pumped to the regulating box of a Jordan beater, whence it passes to the rag beater chest. The mixture of bark and rag is treated in another Jordan beater and then passes to the machine chest. The felt is made on a 72-in. machine with a 36-in. cylinder and 48 ft. dryers. Promising results have also been obtained with mixtures of 20% of unbleached sulphite pulp and 80% of spent hemlock or oak bark for the production of wall papers and fibre onduits. For the manufacture of wall board favourable results were obtained in laboratory tests with mixtures containing sulphite and "kraft" pulp and 80% of waste spruce and balsam bark obtained in the drum barking of pulpwood, and also with mixtures of 50% of bark and 50% of mechanical wood pulp.—A. S.

Fireproof writing paper; Experimental notes on the preparation of—R. G. Myers. J. Ind. Eng. Chem., 1916, 8, 888—889.

THE pulps used were made at 100°C. from chrysotile fibre together with white or lightly tinted precipitates of metallic compounds, and the papers were prepared by a method similar to that used in the manufacture of hand-made Japanese paper. The best papers in regard to tensile strength and closeness of texture were obtained from pulps containing precipitated hydroxides, arsenites, silicates, and tungstates. A paper prepared from a pulp containing a considerable excess of magnesium arsenite in an alkaline mixture was superior in tensile strength and closeness of texture to any of the commercial papers examined. The fire-resisting character of the papers was tested by exposure for 10 hours to a temperature varying from 900° to 1000° C., and it is concluded from the results "that no paper composed of incombustible substances containing molecular water is fireproof or can be made fireproof." Several of the samples, however, were not seriously impaired when exposed to dull red heat for an hour or so. For fireproof inks solutions of ferric, chromic, and cobaltous nitrates and chlorides gave good results. For use with inks other than those prepared with platinum compounds, an excess of acid oxides should be maintained in the paper.—A. S.

Standards for products of the asphalt industry. Marcussou. See IIA.

PATENTS.

Drying machine [for fabrics]. T. Allsop and W. W. Sibson, Assignors to Philadelphia Drying Machinery Co., Philadelphia, Pa. U.S. Pat. 1,198,377, Sept. 12, 1916. Date of appl., Apr. 1, 1915.

A RECTANGULAR chamber is divided by a vertical transverse partition into a heating and a drying compartment. The chamber has a flat roof except over the partition, where there is a peaked portion, the ridge of which is directly over the partition. A fan driven by a shaft which passes through the sloping sides of the peaked roof, is situated in the upper portion of the partition, which extends into the peaked roof. The drying compartment is provided with two superposed endless carriers, one of which has chain ways and centering hooks for stretching fabric.—W. H. C.

Silk waste; Process for treating—to separate the chrysalides and form a sheet or prepare for spinning. Schmid Frères. First Addition, dated Feb. 6, 1915, to Fr. Pat. 462,252, Sept. 6, 1913. Under Int. Conv., Mar. 14, 1914, and Jan. 28, 1915.

THE silk waste may be treated with steam, superheated or not, instead of with soap froth, to render the sericin soluble. Waste which has been treated with steam, soap froth, or alkali is transported automatically on hurdles passing beneath sprays of water. The hurdles are then placed on supports attached to an oscillating shaft which imparts to them the shaking motion necessary to detach the chrysalides; or the waste may be beaten with brushes or brooms in special vessels containing water, so as to form sheets which are hung over movable sticks and worked about in water to remove the chrysalides. The sheets of waste are floated in a vat full of water and repeatedly raked from one end of the vat to the other to parallelise the fibres and divide them into tufts, which are rubbed across a fixed obstacle, then washed, drained, and dried.—J. F. B.

Flax and similar fibrous materials; Treatment of—The Fibres Extraction Proprietary, Ltd. Fr. Pat. 479,780, Sept. 20, 1915.

FLAX, ramie, phormium, agave, or the like is

packed in perforated wagons which are passed on rails through a series of three chambers. The first is provided with distributors of liquid at the top and of steam below, by means of which the material is washed with hot water in an atmosphere of steam. The second chamber has a pit below the level of the rails, provided with heating apparatus and a circulating and distributing system; the material is boiled with a solution containing caustic soda and linseed oil, to which may be added soda ash and tallow. After leaving the second chamber the material is washed with water from a flexible pipe situated between the second and third chambers. In the third chamber, provided with a heating and ventilating system, the material is dried while still in the wagons.—J. F. B.

Carbonising wool; Method of —. I. Teller, Vienna. Ger. Pat. 293,884, Jan. 23, 1915.

AFTER scouring, the wool is treated with a cold saturated solution of zinc chloride in concentrated hydrochloric acid.—A. S.

Paper making machines. C. E. Pope, Holyoke, Mass. U.S. Pats. (A) 1,197,855 and (B) 1,197,856, Sept. 12, 1916. Date of appl., Aug. 25, 1913.

(A) IN a paper machine with moving wire, an endless felt passes round the upper couch roll in contact with the web of pulp carried by the wire; the wire passes forward from the couch press to a guide roll which leads it back, and at a point between the couch press and the guide roll, where the underside of the wire is exposed, means are provided to press the felt against the web of pulp and to guide the latter with the felt away from the wire. (B) The means employed for directing the felt with the adherent web away from the wire may include a device for causing a pneumatic pressure acting through the wire toward the felt, for instance, a stationary suction box above the felt.—J. F. B.

Insulating material [from waste paper] and process for producing the same. G. W. W. Harden, Le Roy, Minn. U.S. Pat. 1,198,028, Sept. 12, 1916. Date of appl., Nov. 15, 1913.

WASTE paper is reduced to a low grade paper pulp, and commingled and felted with long unground stems of raw whole straw in water. The materials are formed into a sheet and dried, the pulp serving as a binder to the straw and the latter as a reinforcement to the pulp and forming air cells in the sheet.—B. N.

Pulp for the manufacture of paper and other purposes; Process and apparatus for obtaining —. S. Milne. Fr. Pat. 478,063, Mar. 17, 1915. Under Int. Conv., Mar. 19, 1914.

PULP prepared from esparto or other material in horizontal rotary digesters, is discharged into a receptacle provided with an agitator, and then passed to a squeezing and washing apparatus (see Eng. Pat. 6948 of 1914; this J., 1915, 488). It is then diluted, and passed through one or more screens to remove the coarser impurities, and subsequently bleached. The coarser fibrous material is passed through a refining apparatus before further treatment. The order of the various operations subsequent to digestion may be varied.

Methyl alcohol and other compounds from waste [soda wood pulp] liquors containing organic matter; Process of forming —. A. H. White, Ann Arbor, Mich. U.S. Pat. 1,197,983, Sept. 12, 1916. Date of appl., Nov. 29, 1915.

THE concentrated liquor is fed gradually into a retort heated to 450° to 700° F. (about 230°—370° C.) where it spreads out into a thin layer and

is rapidly subjected to destructive distillation with foaming and charring, filling the space with a porous black ash; the rate of feed is regulated to maintain the vapour in the retort for from 5 to 150 seconds, varying according to the temperature and amount of contact substance acting as a catalyst, longer for low temperatures and shorter for higher temperatures.—J. F. B.

Evaporation of waste liquors, especially waste liquors from the sulphite- and sulphate-cellulose processes. E. Mürbe, Görlitz. Ger. Pat. 293,394, Jan. 21, 1914.

THE waste liquor is sprayed under pressure into a chamber in which it comes in direct contact with hot waste gases from the boiler furnace. Further concentration is effected in the usual way in separate evaporating chambers.—A. S.

Flax and analogous materials; Retting of —. M. A. Adam, W. J. Fernie, and The Fibre Corporation, Ltd. Fr. Pat. 478,548, Apr. 29, 1915. SEE Eng. Pat. 745 of 1914; this J., 1915, 545.

Ungumming silk or silk wastes; Process for —. Schmid Frères. Fr. Pat. 479,294, July 17, 1915. Under Int. Conv., Jan. 22, 1915.

SEE Eng. Pat. 100,029 of 1916; this J., 1916, 733.

Cellulose; Process for the electric treatment of —. A. L. C. Nodon, Bordeaux, France. U.S. Pat. 1,198,867, Sept. 19, 1916. Date of appl., Feb. 28, 1913. SEE Fr. Pat. 453,111 of 1912; this J., 1913, 785.

Cellulose esters; Manufacture of —. Soc. Chim. Usines du Rhône. First Addition, dated June 3, 1915 (under Int. Conv., June 12, 1914), to Fr. Pat. 473,399, June 12, 1914.

SEE Eng. Pat. 8046 of 1915; this J., 1916, 39.

Insulating material [from Zostera marina fibre], and manufacture of the same. H. B. McFarland and R. J. Shoemaker. Fr. Pat. 478,907, June 4, 1915.

SEE U.S. Pats. 1,146,189 and 1,146,190 of 1915; this J., 1915, 901.

Fireproofing fabrics or other porous or absorbent substances. T. J. I. Craig, and Whipp Bros. and Tod, Ltd. Fr. Pat. 477,857, Mar. 2, 1915. Under Int. Conv., July 7, Aug. 7 and 25, and Dec. 2, 1914.

SEE Eng. Pats. 16,153, 18,310, 19,041, and 23,421 of 1914; this J., 1915, 898.

Process and apparatus for making briquettes from paper or other organic material. Fr. Pat. 479,162. See IIa.

Waterproofing the soles of footwear [with nitro-cellulose, etc.]. Eng. Pat. 12,840. See XV.

VI.—BLEACHING; DYEING; PRINTING; FINISHING.

Dyeing on tussah silk; Black —. R. N. Sen. J. Soc. Dyers and Col., 1916, 32, 243—244.

TUSSAH silk is not attacked by caustic soda so readily as ordinary silk, and in this respect more closely resembles cotton; it is, however, more resistant to hydrochloric acid, and in this respect is more allied to wool. Towards colouring matters tussah silk behaves more like wool than like ordinary silk, e.g. it may be dyed with Prussian blue in the same manner as wool. Details are given for dyeing tussah silk with direct cotton blacks, acid blacks, acid mordant blacks, sulphur blacks, Aniline Black, and logwood.—F. W. A.

Aniline Black on wool; Production of—
R. N. Sen. J. Soc. Dyers and Col., 1916, 32,
244—245.

Wool is prepared by treatment with 6% potassium bichromate and 5% sulphuric acid at 60° C. for half-an-hour, squeezed, rinsed, and then dyed with Aniline Black, preferably twice by Green's air oxidation method, followed by chroming cold for 3 hrs. in a bath containing 4 grms. of potassium bichromate per litre.—F. W. A.

Dyeing wool with sulphur colours. R. N. Sen. J. Soc. Dyers and Col., 1916, 32, 245—246.

The glucose process for dyeing animal fibres with sulphur colours has been modified by substituting ammonium for sodium sulphate, omitting the sodium carbonate, and adding slowly a small amount of formic acid towards the end of the dyeing operation. The methods of Lodge and Evans (this J., 1916, 41) were improved by adding to (a) the sulphide bath a small amount of Turkey-red oil (to improve the penetration and depth of shade) and, towards the end of the dyeing operation, a small amount of formic acid, and (b) to the hydrosulphite vat, ammonium sulphate and Turkey-red oil. New methods are suggested in which sodium sulphide alone, or hydrosulphite and either sodium carbonate or ammonia, are used to dissolve the dyestuff, and ammonium sulphate and Turkey-red oil are added to the dye bath; good blacks are produced.—F. W. A.

PATENTS

Silk for weighting; Protective treatment of—
Schadd and Korteling. Fr. Pat. 478,007, Mar. 12,
1915. Under Int. Conv., Nov. 6, 1914.

Silk is treated before, and if necessary up to, the end of the weighting operation, with organic compounds, particularly those containing nitrogen or sulphur, or both, which are more readily oxidisable than the fibroin and preferably those of which the primary oxidation products still have a reducing action and which yield nothing that can affect the feel or colour of the silk or give stains with metallic salts. *Example:* The silk is treated before or during the weighting operation with a solution containing 2% of sodium hippurate, calculated on the weight of the silk, then drained and loaded by any of the usual processes; hippuric acid is fixed in the fibre by treatment with hydrochloric acid.—J. F. B.

Dyeing rugs and like articles; Process for—
W. E. Olson, Chicago, Ill. U.S. Pat. 1,198,373,
Sept. 12, 1916. Date of appl., May 20, 1914.

Rugs are sprayed with a liquid dye uniformly or otherwise, the surface brushed to force the dye into the nap, the rugs dried, treated in a vapour bath to deposit a film of water on the surface, and finally the dye is fixed.—F. W. A.

Waterproofing of fabrics. A. Vincent and E. Pluszeski. Fr. Pat. 479,436, Dec. 2, 1914.

Textile material for military purposes, etc., is waterproofed by treatment for 8 mins. with the emulsion of calcium oleate, margarate, and stearate obtained from 100 grms. of fat, 900 grms. of benzene, 20 grms. of quicklime, and 80 grms. of water. The benzene is recovered during the drying process.—F. W. A.

Fireproofing and bleaching fabrics and analogous materials. T. J. I. Craig, and Whipp Bros. and Tod, Ltd. Fr. Pat. 479,080, June 23, 1915.
Under Int. Conv., Nov. 17, 1914, and Mar. 22, 1915.

See Eng. Pats. 22,617 of 1914 and 4448 of 1915; his J., 1915, 1205.

VII.—ACIDS; ALKALIS; SALTS; NON-METALLIC ELEMENTS.

Sulphur, pyrites, and sulphuric acid in the United States. U.S. Geol. Survey, 1916.

THE production of sulphur in the United States in 1915 showed a decrease over the previous year; actual figures are not given; 25,910 tons of sulphur was imported. The demand improved gradually as the year advanced, owing to the requirements of sulphuric acid manufacturers. Imports of pyrites amounted to 964,634 tons and production to 394,124 tons. Exports of sulphur fell from 98,163 tons in 1914 to 37,312 tons in 1915. In the sulphuric acid industry, until the middle of 1915 manufacturers were able to meet the demands made on them, but subsequently supplies have been inadequate and prices have consequently increased. The amounts of various strengths produced in the United States last year were: 50° B., 1,518,271 short tons; 60° B., 657,076 tons; 66° B., 1,049,024 tons; other grades, including stronger acid reported as oleum, 189,795 tons. The total, reduced to 50° B. acid, represents 3,868,152 tons, the value being \$32,657,051. Copper and zinc smelters produced the equivalent of 1,056,830 short tons of 50° B. acid during the year, valued at \$7,621,241.

Nitric acid; The Ostwald process of oxidising ammonia to—F. C. Zeisberg. Met. and Chem. Eng., 1916, 15, 299—304.

FROM a résumé of the information available (which is to be regarded with reserve) it is concluded that the Ostwald and similar processes for the manufacture of nitric acid by the catalytic oxidation of ammonia can hardly compete with the sodium nitrate or are processes, the possible margin of profit being very small even when the price of ammonia is low. The process possesses the advantages of being continuous and capable of installation in small units; it also requires little power and relatively small absorption apparatus, the exit gases from the converters being several times as concentrated as those from any arc furnace. It is, however, only a step, not a complete process, and the plant would have to be located with respect to economy of freight on incoming supplies of ammonia liquor or cyanamide, and the cost of ammonia would have to be improbably low for profitable operation. On the basis of 85% and 97% yields for the Ostwald and sodium nitrate processes respectively, and with sodium nitrate and ammonia at the present prices, viz. 2.64 c. (1.32d.) and 13.25 c. (6.62d.) per lb., respectively, the cost of 93% nitric acid would be 5.471 c. (2.73d.) per lb. by the former and 5.5 c. (2.75d.) per lb. by the latter process; the corresponding costs with sodium nitrate at 1.5 c. (0.75d.) and ammonia at 7.5 c. (3.75d.) being 3.621 c. (1.81d.) and 3.88 c. (1.94d.) per lb. respectively. On the basis of equal yields (97%), nitric acid could be produced for about 0.5 c. (0.25d.) less per lb. by the Ostwald than by the sodium nitrate process; but according to the most trustworthy evidence, the conversion efficiency of the Ostwald process appears not to exceed 85%.—W. E. F. P.

Etna lava; Utilisation of—in the chemical industry. S. Pagliani. Annali Chim. Appl., 1916, 6, 157—162.

MOUNT ETNA lava has been used for some years with good results in an Italian works, for the construction of apparatus for the concentration of sulphuric acid. Glover and Gay Lussac towers, condensing towers for hydrochloric acid, and other plant in which Volvic lava or analogous material is usually employed. Not all specimens of the lava are suitable for such purposes, but large quantities

of material of satisfactory quality are available in the quarries. Analyses of samples of the lava deposited at different epochs (from 122 B.C. to 1910) show that the maximum, minimum, and average values for the percentages of the various constituents are as follows:— SiO_2 , 51.89, 46.25, 49.13; Al_2O_3 , 22.67, 15.91, 19.84; Fe_2O_3 , 19.32, 9.13, 11.47; $\text{CaO} + \text{MgO}$, 17.18, 11.60, 13.38; $\text{Na}_2\text{O} + \text{K}_2\text{O}$, 8.41, 2.12, 5.81%. The porosity of a sample of the lava, as measured by the weight of water absorbed per 100 parts of material, was found to be 0.48, as compared with 0.74 for granite. —A. S.

Lime; ferric oxide; Preliminary report on the system — R. B. Sosman and H. E. Merwin. J. Wash. Acad. Sci., 1916, 6, 532–537.

THE system $\text{CaO}-\text{Fe}_2\text{O}_3$ was investigated by means of thermal curves and by optical examination. The mixtures were melted down in platinum crucibles, then ground, and remelted for the determination of the thermal breaks. Temperatures up to 1250° – 1450°C . were employed, the lower temperature with mixtures containing less than 50 molecular per cent. of CaO owing to the considerable dissociation of the ferric oxide at higher temperatures. Two binary compounds were found, $\text{CaO}.\text{Fe}_2\text{O}_3$, and $2\text{CaO}.\text{Fe}_2\text{O}_3$, and both appear to be dissociated at their melting points. $2\text{CaO}.\text{Fe}_2\text{O}_3$ gives black crystals; it is formed from a finely powdered mixture of calcium carbonate and ferric oxide at temperatures considerably below its liquefying point, which lies somewhat above 1385°C . The transition temperature at which it dissociates and is in equilibrium with CaO and liquid is 1436°C . Similarly it is in equilibrium with liquid and with $\text{CaO}.\text{Fe}_2\text{O}_3$ at 1216°C . This latter compound forms deep red or nearly black crystals. There is no optical evidence of solid solution of either $2\text{CaO}.\text{Fe}_2\text{O}_3$, or Fe_2O_3 , in the compound. There is an eutectic at 1203°C . between $\text{CaO}.\text{Fe}_2\text{O}_3$ and Fe_2O_3 (haematite); the eutectic composition is between 10 and 25 molecular per cent. of CaO , probably nearer the latter. No evidence was found of a 3 : 1 compound analogous to tricalcium aluminate; samples of this composition all consisted of the above 2 : 1 compound and CaO .—G. F. M.

Cobalt aluminate, cobalt orthostannate, and Rinman's green; Formation of — J. A. Hedvall. Z. anorg. Chem., 1916, 96, 71–74. Z. angew. Chem., 1916, 29, Ref., 401. (See also this J., 1915, 1052.)

INTERACTION of cobalt oxide and alumina begins between 925° and 1025°C . and at a higher temperature the more slowly the mixture is heated. With a rate of heating such that interaction begins at 1025°C ., the mixture must be heated at 1075° – 1100°C . for 10 mins. to obtain complete conversion into the blue aluminate, $\text{CoO}.\text{Al}_2\text{O}_3$. When the green aluminate, $7\text{CoO}.\text{Al}_2\text{O}_3$, is also formed, the reaction velocity is considerably retarded: the greenish-blue product is converted into the pure blue aluminate in about 20 mins. In presence of potassium chloride as flux, formation of $\text{CoO}.\text{Al}_2\text{O}_3$ takes place even at 776°C . (the melting point of the chloride).

When a mixture of cobalt oxide and stannic oxide is heated somewhat rapidly, interaction begins only at about 1000°C . even in presence of potassium chloride, and at about 1075°C . in the case of a mixture which has been heated previously. The formation of green cobalt orthostannate, $\text{Co}.\text{SnO}_2$, proceeds with somewhat higher velocity than that of the blue aluminate.

The temperature of formation of Rinman's green from zinc oxide and CoO or Co_2O_3 is about 790° – 800°C . In absence of potassium chloride the

reaction is much slower than the formation of aluminate or stannate.—A. S.

Design of acid-resisting iron apparatus. Swindin. See I.

Exchange of bases by silicates. Exchange of alkalis and ammonium by hydrous aluminium-alkali silicates (permutites). Ramann and others. See XIXB.

Determination of sulphuric anhydride. Pierce See XXIII.

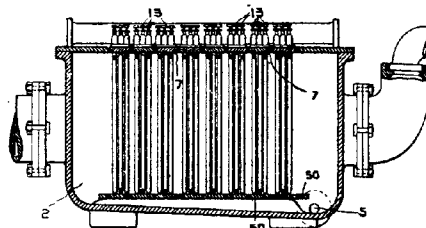
Use of titanium trichloride in volumetric analysis. Monnier. See XXIII.

Detection of small quantities of selenium and their distinction from arsenic. Meunier. See XXIII.

PATENTS.

Condensers [for nitric acid]. A. Hough, Dragon Station, Quebec. Eng. Pat. 101,307, Feb. 24, 1916. (Appl. No. 2792 of 1916.)

NITRIC acid or other vapour is passed into a container, 2, of dish form, provided with a cover



divided into a number of detachable parts, 7, and having a trapped outlet, 5, at the lower end of the inclined base. In the interior of the container is a series of vertical tubes, preferably of glass, of three-loop zig-zag shape, the ends of which protrude upwards through apertures in the cover in which they are fixed by cement, and which rest upon a false bottom, 50, situated near the base of the container. Water flows through these tubes in the opposite direction to the incoming vapour. The condenser units are connected to inlet and outlet headers by a series of nipples, fixed to the headers, and by flexible tubing, each nipple being provided with a controlling tap, 13.—E. H. T.

Nitric acid; Production of — H. D. Rankin. Fr. Pat. 479,492, Aug. 10, 1915.

SEE U.S. Pat. 1,150,786 of 1915; this J., 1915, 960. The electrical resistance of the mixture of oxygen and nitrogen may be diminished by addition of steam. The nitrogen oxides produced in the reaction chamber are cooled to prevent dissociation and decomposition, and are then led to a vessel containing a mixture of sulphuric acid and water, and air also is introduced into this vessel.

Nitrogen oxides; Manufacture of — J. Y. Johnson, London. From Badische Anilin u. Soda Fabr., Ludwigshafen, Germany. Eng. Pat. 13,297, May 21, 1915. (See also Eng. Pats. 7651 and 13,298 of 1915; this J., 1916, 1015.)

THE bismuth or bismuth oxide contained in the contact mass described in Eng. Pat. 13,818 of 1914 (this J., 1915, 799) may be replaced by tellurium or a tellurium compound, in an amount which may be varied within wide limits, and upon a carrier consisting of a noble metal or an indifferent substance. Thus the following may be used as contact masses at 700° – 800°C .: Powdered fire-brick soaked in a 10–20% solution of platinum

chloride, and in a solution of about 10% ammonium or sodium tellurite (either separately or mixed); a metal of the platinum group deposited on the carrier and then rendered active with a small amount of tellurium or one of its compounds; granular cupric oxide is soaked in a 5% solution of ammonium tellurite and dried. (Reference is directed in pursuance of Sect. 8, Sub-sect. 2, of the Patents and Designs Act, 1907, to Eng. Pat. 2308 of 1914.)—E. H. T.

Sodium silicate; Soluble composition of—, and *process of preparing the same.* L. B. Edgerton, Upland, Pa. U.S. Pat. 1,198,203, Sept. 12, 1916. Date of appl., Dec. 8, 1914.

A SOLUTION of sodium silicate is deprived of some of its water by injecting it, in a finely-divided form, into a large volume of dry air, moving in the same upward direction and heated to between 140° and 200° F. (60° and 92° C.).—E. H. T.

Alkali chlorides; Electrolysis of—, R. van Hasselt, The Hague, Netherlands. Eng. Pat. 101,440, Mar. 21, 1916. (Appl. No. 4190 of 1916.)

A HIGHLY concentrated salt solution is circulated through the anode compartment, entering at a level a little above a horizontal diaphragm and leaving in a slightly impoverished condition at a higher level. It is then passed into a salt chamber, in which the liquid is kept alkaline, where it is heated to expel the chlorine and is re-saturated with salt. After filtering, the liquid is returned to the anode compartment, the velocity of flow and the composition of the fresh salt solution being regulated to compensate for the volume of liquid passing through the diaphragm.—B. N.

Cyanides and ammonia or its salts; Preparation of—by the *Marguerite and Sourdeval process.* L. Petit Devaucelle and F. Bensa. Fr. Pat. 478,919, Sept. 9, 1914.

IN the manufacture of cyanides by heating together a metallic oxide or carbonate and a carbonaceous material in the presence of nitrogen, a fairly pure salt or oxide of an alkali or alkaline-earth metal (e.g., precipitated barium carbonate) is used; a carbon is selected, having a low ash content, e.g., that obtained from tar, petroleum, nitracite, etc.; the mixture of salt or oxide and carbon is agglomerated preferably by admixture with 20% of tar; the nitrogen used is also as pure as practicable. In the subsequent conversion of the cyanide into ammonia by the action of steam, the necessary reduction of temperature, previous to the reaction, is preferably produced by cooling the mass with a stream of cold air rather than by cooling the retort. By observing these precautions the cyanide reaction occurs at a lower temperature and a better yield is obtained in both processes at a lower cost of fuel and plant.—B. V. S.

Sodium carbonate; Rapid preparation of fine crystals of—, R. Bernat. Fr. Pat. 479,545, Aug. 17, 1915.

A HOT saturated solution of sodium carbonate is quickly cooled by causing it to flow over a shallow dish, cooled externally. The mixture of crystals and mother liquor is further cooled by the addition of powdered ice. The preliminary cooling with dishes may be omitted, more ice being then required. Very small, needle-shaped crystals are obtained, suitable for the preparation of washing powders, easily soluble in cold water.—B. V. S.

Plastic lime; Manufacture of—, J. Mühlen, Wiesbaden. Ger. Pat. 293,825, Sept. 26, 1915.

PLASTIC lime is dry slaked, the pulverulent slaked

lime is separated as one finished product, and the residue is mixed with fresh quicklime and finely ground to form a second finished product.—A. S.

Chlorine; Cheap process for the manufacture of—, P. R. Fallek. Fr. Pat. 479,196, July 5, 1915.

A HOT saturated solution of sodium chlorate is dropped, a little at a time, into a hot solution of sodium bisulphate and chloride, the strength of this solution being such that no hydrochloric acid is evolved in the cold and only a little when heated to boiling point. A steady evolution of chlorine, free from oxides, is obtained. A part of the bisulphate and chlorate may be replaced by the nitric-sulphuric acid mixtures left from the manufacture of gun-cotton.—B. V. S.

Caustic alkalis, etc.; Electrolytic manufacture of—, E. A. Ashcroft, London. U.S. Pat. 1,198,987, Sept. 19, 1916. Date of appl., Mar. 12, 1912. SEE Eng. Pat. 1004 of 1912; this J., 1913, 199.

Nitrogen; Process for fixing—by means of *ferro-aluminium or other ferro-alloys.* O. Serpek, Assignor to Soc. Gén. des Nitrures, Paris. U.S. Pat. 1,198,965, Sept. 19, 1916. Date of appl., Dec. 20, 1913.

SEE Eng. Pats. 27,030 and 27,971 of 1913; this J., 1914, 549, 961.

Cyanogen compounds; Manufacture of—, Nitrogen Products Co. Fr. Pat. 477,918, Mar. 8, 1915. SEE Eng. Pat. 2286 of 1915; this J., 1916, 422.

Receptacles for carrying out chemical reactions. Eng. Pat. 100,447. See I.

Kiln for lime, cement, and other similar materials. Fr. Pat. 478,401. See IX.

Preparation of base-exchanging substances. Fr. Pat. 479,152. See XIXB.

VIII.—GLASS; CERAMICS.

PATENTS.

Glass-drawing and blowing apparatus. A. F. White, London. From Window Glass Rotary Pot Co., Pittsburgh, Pa., U.S.A. Eng. Pat. 18,126, Dec. 29, 1915.

A GLASS-DRAWING or -blowing apparatus for producing window glass is arranged so that movement of the rotary hearth and the heating of the furnace are automatically controlled by mechanical and electrical means. The furnace has four stations, so arranged that whilst one pot is being filled with a charge of glass from a separate tank furnace at the first station, a glass cylinder is being withdrawn from another pot at the third. Between the first and second station the supply of gas or oil to the furnace is reduced so as to render the glass more viscous; and at the fourth station the pot and any surplus glass in it are re-heated so as to be ready to receive a fresh charge. By the motion of the rotary hearth, which is driven electrically, the pots are automatically taken to each station in turn. The rotary hearth also controls automatically the supply of air and fuel (oil or gas) to the several sections of the furnace, regulating the temperature of the glass at each station, and cutting off the heat when the hearth is in motion. The glass is drawn in the form of a cylinder by lowering a head or bait into the molten material and then raising it slowly, air being supplied automatically to expand the cylinder as it is formed by the rising bait. The diameter of the cylinder is kept uniform by manipulating the

speed of the motor. When of the proper size, the cylinder is moved automatically to the drawing station and is cut off by means of a series of gas jets arranged on the periphery of a steel ring.

—A. B. S.

Quartz glass or similar refractory glasses; Gas-tight sealing of wire in — E. Podszus, Neukölln. Ger. Pat. 293,963, Mar. 15, 1914. Addition to Ger. Pat. 290,606.

A QUANTITY (1—2%) of alkali or alkaline-earth, sufficient to dissolve the oxide on the surface of the wire, is added to the flux described in the chief patent (this J., 1916, 802). The alkali may be added in the form of orthoclase, a suitable flux being composed of silica 10, alumina 1, boric oxide 1, and orthoclase 2 parts.—A. S.

Refractory materials; Production of — P. R. Hershman, Chicago, Ill., Assignor to The Mineral Products Co., New York. U.S. Pat. 1,197,626, Sept. 12, 1916. Date of appl., Dec. 21, 1914. Renewed Feb. 4, 1916.

BRIQUETTES, formed of a mixture of alumina with from 10—30% of finely divided carbon, are heated slowly in a non-oxidising atmosphere consisting mainly of hydrocarbon gases until the mixture frits together.—W. H. C.

Pottery and like kilns; Gas-fired — South Metropolitan Gas Co., and D. Chandler, London. Eng. Pat. 101,567, Jan. 9, 1916. (Appl. No. 874 of 1916.)

A RECTANGULAR down-draught kiln has a perforated floor at the bottom and another, hollow, perforated floor about midway of its height, for supporting the articles to be burned. It is heated by two sets of flat-flame gas-burners on opposite sides; the flames from one set project upwards through side flues or "bags" to the top of the kiln, whilst the flames from the other set project horizontally into the space between the walls of the hollow floor, and pass downwards through the lower half of the kiln. Several kilns may be connected in series, and worked in pairs, so that the waste heat from one kiln may be used to dry the contents of another. Compressed air may be used to regulate the draught.—A. B. S.

Kilns. L. W. McArthur, Assignor to P. S. McKergow, Montreal. U.S. Pats. (A) 1,199,015 and (B) 1,199,016, Sept. 19, 1916. Dates of appl., Feb. 16 and May 1, 1916.

(A) A KILN for burning bricks is provided with a floor composed of layers of separate slabs arranged to form tortuous flues for the hot gases passing from a generator below into the heating chamber. The top of the kiln is open, but openings in the side walls near the top cause an outward draught into vertical flues in the walls which lead first downwards and then upwards into chimneys which form vertical continuations of the side walls. (B) In a kiln of the type described in (A), the openings in the side walls are wide and shallow, decreasing in width and increasing in depth from the inner side of the wall outwards. The flues are arranged in groups, each of which communicates with a separate chimney.—W. F. F.

Muffle-furnace for burning-in colours on glass, porcelain, etc.; Gas-fired — S. Schieren, Cöln-Junkersdorf. Ger. Pat. 293,343, Feb. 9, 1913.

THE furnace is so constructed that it can quickly be modified for rapid working. For this purpose the burners are mounted on a support so that they can be moved sideways and raised in the side flues to such a height that the heating gases

circulate only around the upper part of the muffle chamber; and the damper in the plate closing the bottom of the furnace chamber is opened, so that cool air can circulate in contact with the bottom of the muffle. The articles are placed on supporting plates in the muffle chamber and are heated from above in the upper part and cooled in the lower part.—A. S.

Supporting tiles, more especially whilst subjected to heat treatment. P. d'H. Dressler, London. Eng. Pat. 12,581, Sept. 1, 1915.

Kilns. L. W. McArthur and P. S. McKergow, Montreal. Eng. Pat. 101,583, Mar. 22, 1916. (Appl. No. 4265 of 1916.)

SEE U.S. Pat. 1,199,015 of 1916; preceding.

Chequer bricks used in the chequering chambers of carburetted water-gas plant or coke-oven chambers. Eng. Pat. 16,634. See IIA.

IX.—BUILDING MATERIALS.

Concrete; Effect of prolonged keeping of — in a wet condition on its subsequent shrinkage on hardening in air. M. Rudeloff. Mitt. K. Material-prüf., 1916, 34, 2—11.

TEST-PRISMS of concrete were allowed to set: (1) continuously exposed to the air, (2) continuously under water, (3) exposed to air for varying periods and then immersed in water, and (4) immersed in water for varying periods and then exposed to the air. The experiments were made in 1912, and the detailed results were published in "Heft 23 des deutschen Ausschusses für Eisenbeton." Since 1912 the test-pieces have been kept exposed to the air in a dry cellar, and the changes in length have been again measured. Some of the results are summarised in the following table:—

| Conditions of setting. | Measurements in 1912. | | | Measurements in 1916. | |
|--|----------------------------|---------------------------------------|-----------------------------------|---|--------|
| | Age of test-piece in days. | Change of length, % × 10 ⁴ | Exposure to air since 1912, days. | Change of length, % × 10 ⁴ , since 1912. | total. |
| Exposed to air.. | 196 | —324 | 1372 | +1 | —323 |
| Under water .. | 196 | +328 | 1365 | —252 | +46 |
| 188 days under water, 3 days after | 171 | +323 | 1409 | —213 | +110 |
| 14 days exposure to air for 21 days | 182 | +312 | 1411 | —206 | +106 |
| | 189 | +310 | 1411 | —266 | +45 |
| | | +176 | 1411 | —266 | —90 |
| 140 days exposed to air for 140 days after | 144 | —102 | 1378 | —205 | —307 |
| 7 days keeping | 148 | —86 | 1378 | —204 | —290 |
| 28 days under water for 90 days | 169 | —11 | 1378 | —208 | —219 |
| | 231 | +145 | 1378 | —191 | —16 |

—A. S.

Oak; Ancient Irish — P. A. E. Richards. Analyst, 1916, 41, 303—304.

STUMPS of ancient oak are found in various parts of Ireland buried in peat bogs and in sand and mud near the sea; they probably date back to the Neolithic period and in some respects resemble the Russian oaks described previously by the author (this J., 1916, 738). The specimens examined had the following compositions:—

| | Kerry (black). | Roscommon (black). | (grey). | Sligo (brown). | Anna- gassan (fr sea). |
|--|-------------------|-----------------------|---------|-------------------|------------------------------|
| | % | % | % | % | % |
| Total mineral matter | 2.31 | 1.46 | 1.09 | 0.28 | 6.33 |
| Ether-alcohol extract | 4.37 | 7.88 | 7.24 | 5.5 | 5.02 |
| Water and total extractives | 44.3 | 40.5 | 36.2 | 39.6 | 38.7 |
| Cellulose | 27.3 | 31.4 | 37.6 | 39.3 | 44.4 |
| Lignin, etc. | 28.4 | 25.1 | 26.2 | 21.1 | 15.9 |
| The mineral matter contained— | | | | | |
| Fe ₂ O ₃ | 62.70 | 33.90 | 25.80 | 3.95 | 0.37 |
| Al ₂ O ₃ | trace | trace | trace | 1.65 | 0.30 |
| CaO | 16.24 | 34.22 | 38.61 | 16.42 | 4.10 |
| MgO | none | 0.80 | 1.02 | 15.28 | 7.27 |
| SiO ₂ | 2.30 | 0.70 | 0.80 | 7.80 | 1.80 |
| SO ₃ | 5.83 | 4.65 | 3.42 | 30.80 | 14.58 |
| Cl | 1.10 | trace | trace | 0.70 | 38.20 |
| CO ₂ | 9.53 | 25.20 | 28.40 | 13.70 | 3.40 |
| Na & K salts | 3.30 | traces | traces | 11.70 | 68.20 |
| Percentage of mineral matter soluble | 13 | 8 | 6 | 56 | 90 |

—W. P. S.

Standards for products of the asphalt industry.
Marcussou. See IIA.

PATENTS.

Metal coating upon cement-mortar, plaster-mortar, or gypsum-mortar, trass-mortar, and the like, with or without admixture of sand, granite, marble, and the like; Process for forming a—
L. A. and A. J. Sanders, Amsterdam. Eng. Pat. 14,226, Oct. 7, 1915.

CEMENTITIOUS material or mortar is mixed with metal (e.g. iron filings) or metal ore (titanic iron sand), water, and sand, stone, or graphite. The paste thus produced is applied as a coating or moulded to the desired shape, and after it has hardened, a metal coating is formed on it by the application of a solution of a salt of a suitable metal. Thus, copper sulphate will react with the iron, and metallic copper will be precipitated. The metallic coating is stated to adhere well, and to be impermeable to water, oil, and benzene.
—A. B. S.

Fire- and waterproof composition [for wood] and process of making same. J. V. Skeglund, New York. U.S. Pat. 1,194,558, Aug. 15, 1916.
Date of appl., Aug. 15, 1913.

A COMPOSITION suitable for coating porous materials such as balsa wood and other soft woods is made by mixing a brominated coal-tar hydrocarbon with a heavy hydrocarbon. Example:—Four parts of gas tar or "dead oil" is treated with 2 parts of bromine; when the reaction has subsided the product is melted with about 20 parts of pitch. The composition is applied in the fused condition to the articles to be coated. It does not sink into the pores and is inflammable only with difficulty.—J. F. B.

Kiln for lime, cement, and other similar materials.
A. Anker. Fr. Pat. 478,401, July 30, 1914.

THE material is caused to descend uniformly over the whole cross-section of the kiln by providing a discharge opening in the bottom of the full cross-section. The material is removed in layers by an endless chain running over a flat plate and provided with transverse ribs projecting upwards. Alternatively the chain may run below a series of parallel bars on which the charge rests, projections carried by the chain extending upwards into the lowest layer of material. In each case the plane of discharge is slightly inclined downwards, or two such discharge conveyors may work outwards from the centre of the discharge opening.—W. F. F.

Artificial stone; Manufacture of— from magnesite and a magnesium salt. E. Wallin, Hamburg-Seddel. Ger. Pat. 293,283, Mar. 12, 1914.

MAGNESIUM nitrate or a mixture which yields magnesium nitrate by chemical interaction is used in the preparation of magnesium artificial stone. The materials may be mixed dry and water added when required for use.—A. S.

Lime-sand mortar; Method of improving—
Mörtelwerk "Jolit" G.m.b.H., Berlin. Ger. Pat. 293,415, Aug. 17, 1913.

DISSOLVED or emulsified silicates, are sprayed on to the finished mortar, whereby better results are obtained than when silicates are incorporated during the preparation of the mortar.—A. S.

Waterproof cement; Manufacture of— W. Giese, Cöthen. Ger. Pat. 293,715, Mar. 16, 1915.

SMALL quantities of alkali silicate and of a calcium compound, preferably the chloride or carbonate, are added during the grinding of the cement clinker. The strength of the cement is not reduced as is the case when alkali silicate alone is added.
—A. S.

Cement or hydraulic lime from calcium sulphate; Process of manufacturing— L. P. Basset, Montmorency, France. U.S. Pat. 1,198,816, Sept. 19, 1916. Date of appl., Dec. 17, 1912.

SEE Addition of Oct. 21, 1912, to Fr. Pat. 455,062 of 1912; this J., 1913, 915.

Cement or hydraulic lime from plaster; Process of manufacturing— L. P. Basset, Montmorency, France. U.S. Pat. 1,198,817, Sept. 19, 1916. Date of appl., Nov. 25, 1913.

SEE Eng. Pat. 12,027 of 1912; this J., 1913, 793.
Excess of calcium sulphate is used.

Manufacture of caustic lime. Ger. Pat. 293,825.
See VII.

X.—METALS; METALLURGY, INCLUDING ELECTRO-METALLURGY.

Blast-furnace slags; Properties of—and methods employed for calculating the charges. M. A. Pawloff. Rev. Soc. Russe Métal., 1914, 1, 652—679. Rev. Mét., 1916, 13, Ext., 50—60.

IN calculating the charge of a blast-furnace, the relation between the ore, the flux, and the fuel-ash, must be determined so that the quantity and composition of the slag may correspond to the kind of iron desired. The amount of slag is kept as low as possible, for reasons of economy, and the quality, as determined by the physical properties and chemical composition, is chosen to favour the reduction of the elements desired in the metal, whilst opposing the passage to the metal of objectionable substances. The fluidity of blast-furnace slags is almost entirely dependent on the relative proportions of (SiO₂ + Al₂O₃) and CaO. Normal slags in charcoal furnaces contain 65 to 60% (SiO₂ + Al₂O₃), and the ratio $\frac{\text{SiO}_2 + \text{Al}_2\text{O}_3}{\text{CaO}}$ varies only from 2 to 1.5. When coke is used the proportion of lime must be increased on account of the sulphur. In these slags the ratio $\frac{\text{SiO}_2 + \text{Al}_2\text{O}_3}{\text{CaO}}$ approaches unity, corresponding to 40—50% (SiO₂ + Al₂O₃), the average content of CaS being 5%. The second important physical property of slags is the heat required for melting. In charcoal furnaces the most fusible slags with a heat of fusion between 340 and 400 cal. per kilo. are

chosen; in coke furnaces the degree of fusibility is generally within the limits 350 and 460 cals. Diagrams showing the degree of fusibility of slags with varying amounts of lime, alumina, and silica, are given, with additional lines for the ratios $\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3}$ and $\frac{\text{RO}}{\text{SiO}_2}$. Slags having different chemical compositions may possess the required fluidity and degree of fusibility, and the composition selected will depend on the kind of iron desired. The proportion of sulphur retained by the slag depends on the proportion of lime (or of $\text{CaO} + \text{MgO} + \text{MnO}$). Silica does not exceed 38% in the slags of modern coke blast-furnaces. Charcoal furnace slags are characterised by a smaller lime content, ore for these furnaces being desulphurised, when necessary, by preliminary roasting. The reduction of manganese also depends directly on the proportion of lime and magnesia in the slag, and to prevent the formation of infusible masses in the furnace, lime is often replaced by magnesia. In the manufacture of ferromanganese the slag may contain up to 12% MgO , with 38—36% CaO . The reduction of silica is, on the contrary, prevented by the presence of much lime and magnesia in the slag, and, other things being equal, the consumption of fuel required to cause the passage of a certain quantity of silicon into the iron is less as the amount of $(\text{SiO}_2 + \text{Al}_2\text{O}_3)$ in the slag is higher. With charcoal, the $(\text{SiO}_2 + \text{Al}_2\text{O}_3)$ may attain 70% of the weight of the slag, but with coke, in view of the necessity of eliminating sulphur, the slag should not contain more than 45 to 50% $(\text{SiO}_2 + \text{Al}_2\text{O}_3)$. Where high temperatures are employed, less lime is needed, as the sulphur is partly volatilised. The reduction of phosphorus is complete when the ratio $\frac{\text{CaO}}{\text{SiO}_2} = 1.65$. The

quantity of slag formed depends on local conditions. With charcoal, a minimum of 25% of the weight of the iron may be attained; with coke, the proportion varies from a minimum of 40% to a maximum of 150%, the latter amount being formed in smelting Cleveland ores. The weight of coke required varies from 80 to 120% of the weight of iron produced, and rises to 200 to 250% for ferromanganese and ferrosilicon. The determination of the quantity of flux necessary for slagging the ash of the fuel and the gangue of the ore may be based on four different quantities:—

(1) *The ratio of the oxygen of the silica to that of the base of the slag.* This method is only suitable for charcoal furnaces, the ash of the fuel taking no part in the action, and the ratio $\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3}$ in the slag being given directly by the analysis of the ore. The most fusible and most acid slag being the most advantageous, and the ratio $\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3}$ being known, a suitable degree of acidity may be obtained by reference to the diagrams. (2) *The ratio (by weight) $\frac{\text{SiO}_2 + \text{Al}_2\text{O}_3}{\text{RO}}$.* This ratio, proposed

by Platz, is a better basis for calculating the charge than the former ratio. In coke furnaces its value is generally made $\frac{48}{52}$ for cast irons and $\frac{48}{48}$ for irons to be refined. An objection however to the use of a constant figure for this ratio is that the properties of slags may vary according to the relative proportions of SiO_2 and Al_2O_3 . In charcoal furnaces the ratio $\frac{\text{SiO}_2 + \text{Al}_2\text{O}_3}{\text{RO}}$ is generally about

$\frac{63}{37}$. As is shown in the diagrams, slags with 37% CaO may vary largely as regards Al_2O_3 and SiO_2 , without raising the heat of fusion above 360 cals., and with the ratio $\frac{63}{37}$ fusible slags are given for

all values of $\frac{\text{SiO}_2}{\text{Al}_2\text{O}_3}$ between 1 and 30. (3) *The ratio (by weight) $\frac{\text{RO}}{\text{SiO}_2}$.* In this method alumina is

considered as neutral. In coke furnaces the ratio varies from 1.65 for the most basic and least fusible slags, to 1.20 for the most fusible slags. The usual value is 1.4 to 1.5. This method is not suitable for calculating the charges of charcoal furnaces. (4) *The content in the slag of SiO_2 , CaO , $(\text{SiO}_2 + \text{Al}_2\text{O}_3)$, or RO .* This method is equally suitable for coke and charcoal furnaces. The most suitable constituent to consider in both cases is $(\text{SiO}_2 + \text{Al}_2\text{O}_3)$.—T. St.

Cast-iron; Corrosion of.—O. Bauer and E. Wetzel. Mitt. K. Materialprüf., 1916, 34, 11—40.

CAST-IRON embedded in moist soil is subject to a peculiar form of corrosion, known as "graphitisation," "iron cancer," etc., in which it is converted locally into a soft, friable, grey mass (compare Steel, this J., 1910, 1141). The authors have investigated a number of cases of corrosion of this type and also made experiments with the object of producing similar effects in laboratory tests. Their results indicate that the fundamental condition for the production of corrosion of this kind is the presence of water in the liquid state. The phenomenon is usually associated with grey cast iron, but white cast iron may be corroded in a similar manner. The corrosion is accelerated by the application of an electric current, e.g. by stray currents in the soil, but also takes place, though much more slowly, in the absence of external electric currents. The oxidation products of the iron, in a spongy condition at first, are retained in place by the network of graphite in the case of grey cast iron, or of cementite in the case of white iron, and are gradually agglomerated to a more or less firm mass. In grey cast iron the corrosion appears always to proceed from the laminae of graphite and gradually to spread outward.—A. S.

Steel; Elastic limit of.—N. I. Belaiw and N. T. Goudtsow. Rev. Mét., 1916, 13, 116—148.

THE upper part of a 1000 kilo. ingot of Martin steel (C 0.34, Mn 0.60, Si 0.26, S 0.036, P 0.034%) to the extent of 40% of the length, the bottom 5% of the outer surface, and the central core 101.6 mm. in diameter, were discarded, and the remaining steel, free from any possible variability in composition, was cut up into bars, which (some after forging) were then subjected to a variety of heat treatments, and tested mechanically. The steel gave one arrest, on heating, at 735° C., and two arrests on cooling, Ar 3—2 at 735° C., and Ar 1 at 690° C. Specimens of each bar were tested on different machines to make the results as independent as possible of the method of determination. *Effect of annealing temperature on the mechanical properties.* Under similar conditions of slow cooling, variation of the temperature of annealing within the limits 1100° and 850° C. had no influence on the mechanical properties. The progressive lowering of the annealing temperature from 850° to 740° C. lowered the tensile strength, and increased the elongation and reduction of area. Micrographic examination showed a transition from lamellar to stippled pearlite, characterised by a fine distribution of cementite in the ferrite. The ratio of the loads corresponding to the apparent elastic limit (yield point) and to the proportional elastic limit (maximum load up to which increase in length is proportional to the load) gave a constant value, the curves of the variations of these loads with annealing temperature being parallel. With the lowering of the annealing temperature from 850° to 740° C. the most marked variation was that of the reduction

of area. *Effect of the reheating temperature after quenching at 760° C.* Raising the reheating temperature restored to the steel its initial mechanical properties. When quenched and reheated at 750° C. it had the same properties as when annealed at this temperature. The curve of reduction of area plotted against reheating temperatures gave a maximum at 650° C. The loads corresponding to the proportional and apparent elastic limits varied together with the reheating temperatures. The differences in the values of the critical points obtained in tensile tests on the same bar were greater as the reheating temperature was lower. Similar results were also obtained with a steel containing C 0.42, Mn 1.00, Si 0.35%. The results showed that a medium carbon steel, after being annealed at above 850° C., acquires a granular structure, its tensile strength increases, and the reduction of area diminishes. Annealing at 740° C., on the contrary, renders the structure more homogeneous, lowers the tensile strength slightly, and increases the reduction of area considerably. Maximum stress and elastic limit (apparent and proportional) can only be considerably increased by quenching followed by reheating, the most favourable temperature for the latter being 650° C. Tests made to ascertain the effects on static tests of heterogeneity produced mechanically and by non-uniform heat treatment showed that the greater the heterogeneity, the lower were the loads corresponding to the elastic limits (proportional and apparent). Similar results were given by a eutectoid steel after being annealed at 1000° C., whereby coarsely lamellar pearlite was produced. The normal mechanical properties were only acquired when the pearlite had been brought into the granular condition, as by annealing at 740° C. The authors consider that the proportional elastic limit should not be used in specifications, as this value is largely affected by non-essential factors, and may thus give a false idea of the object tested. The clearest indications of the mechanical properties are given by a stress-strain diagram produced automatically, but failing the necessary apparatus, it is necessary and sufficient to determine the apparent elastic limit (the yield point).—T. ST.

Cobalt and Fe₃Co; Magnetic properties of—. H. T. Kalmus and K. B. Blake. Mines Branch, Dept. of Mines, Ottawa, Canada. 1916. No. 413. 18 pages. (See also this J., 1914, 261; 1915, 180, 619.)

The magnetic permeability and hysteresis loss of pure cobalt (99.6% Co) were measured by the authors and others. The results obtained are given in a series of diagrams. Similar measurements were also made on the alloy Fe₃Co and comparisons made between the latter, pure iron, and commercial transformer steel. The alloy was brittle but fairly strong and could be readily forged. The ultimate strength after annealing—about the same as that of pure iron—was more than doubled by forging. Sound castings of the alloy were difficult to obtain, most of the castings prepared lacking cohesion, as indicated by microscopic examination. The alloy had a saturation value of magnetisation from 10 to 13% higher than that of pure iron. The best castings (from melting in a vacuum) had a maximum permeability of about 13,000 at a density of 8000 gauss, which, although considerably lower than the corresponding value for pure iron, is much greater than that of standard transformer steel or other commercial materials. The permeability of the alloy in medium fields (50–200 gilberts per cm.) was approximately 25% greater than that of pure iron or commercial grades of transformer steel or iron; the hysteresis loss at 10,000 gauss was considerably less than for the best grades of

commercial transformer steel, and at 15,000 gauss about the same as for commercial iron at 10,000 gauss. The alloy should thus be of great value in parts of electromagnetic machinery where extreme magnetic densities are required.—W.E.F.P.

[Silver.] *Cupellation losses in assaying*. H. T. Mann and C. Y. Clayton. School of Mines and Metallurgy Bull., University of Missouri, Feb., 1916. 60 pages.

The following conclusions have been drawn from the results of more than 600 experiments. 1. *Losses due to composition of cupels.* A mixture of equal parts of bone-ash and cement gave trouble through spitting, and the beads did not break clean from the cupels. Cupels made of a cement base with bone-ash top were very satisfactory as regards silver losses, but the bond between the base and the top is very weak. The loss of silver was highest with cement cupels; the beads were held very firmly and had to be scraped. Morganite cupels showed the smallest silver losses; the beads separated very readily and clean, but below 850° C. they retained lead. Next to Morganite, Braunite cupels were best as regards losses, but spitting was very marked. The beads very easily removed, but below 800° C. they retained lead. A few figures showing the actual silver losses are tabulated below:—

| Composition of cupel. | Cupellation temperature. | Silver loss, %. |
|------------------------------|--------------------------|-----------------|
| | ° C. | |
| Bone-ash | 751 | 1.5 |
| Bone-ash | 855 | 4.8 |
| Bone-ash | 951 | 13.1 |
| Bone-ash | 751 | 2.2 |
| Bone-ash and cement (1:1) .. | 849 | 6.3 |
| Bone-ash and cement (1:1) .. | 951 | 13.2 |
| Cement | 751 | 3.0 |
| Cement | 851 | 9.2 |
| Cement | 959 | 19.4 |
| Cement | 775 | 0.0 |
| Morganite | 851 | 0.6 |
| Morganite | 955 | 2.8 |
| Braunite | 755 | 0.4 |
| Braunite | 855 | 2.5 |
| Braunite | 951 | 5.2 |

2. *The effect of moisture, hardness, and surface condition of the cupels on the loss* was very small; with soft cupels slightly less time was required than with hard ones. 3. *Size of bone-ash.* Provided the bone ash was finer than 60-mesh, the size of the particles did not affect the losses. 4. *Composition of assay slag.* The chemical composition of the slag had very little effect upon the silver recovery so long as the charge for the assay was so proportioned that the ore was completely decomposed; a fluid slag was formed; the proper amount of "collector" was furnished at the proper time; and the lead button was free from objectionable impurities.—W. R. S.

[Cyaniding silver ores.] *The manganese-silver problem*. W. Neal. J. Chem. Met. and Min. Soc., S. Africa. 1916, 17, 9–18.

THE ores from the El Favor Mine (State of Jalisco, Mexico) contain 3.5% of manganese, chiefly as oxide, and 20 oz. of silver per ton, probably as proustite. Only the manganese present as oxide interferes with the cyanide process, silver occurring with manganese carbonate and silicate being generally readily soluble. In this case the extraction of silver by cyanide was 10–45%, and many processes were tried experimentally in order to increase the yield. Concentration by gravity gave a product assaying 100 oz. per ton, but this only accounted for 18.8% of the silver present. Magnetic separation on Wetherill machines removed the oxides of manganese, and the tailings were amen-

able to direct cyaniding. The magnetic fraction should yield most of its silver by chloridising roasting followed by leaching with cyanide or thiosulphate. Leaching the crude ore with cyanogen bromide was a failure. By roasting the ore for 15 minutes at 480° C. with 2½% of salt, and then treating with cyanide, a 76.7 to 82.3% extraction was obtained; 124% of the silver was volatilised. Reducing roasting with powdered coal, followed by cyaniding gave a 75% extraction. Preliminary leaching with sulphuric acid and a reducing agent gave a product which, after cyaniding, contained less than 2 oz. per ton: ferrous sulphate was found to be very efficient and cheap, but oxalic acid proved too costly. Sulphurous acid gave such good results in the laboratory that it was decided to instal an experimental 5-ton plant at the mine as soon as conditions in Mexico make it possible to resume work. The silver refractory to cyanide was found to be equally so to flotation.—W. R. S.

Cyanide solutions; Electrolytic precipitation from
G. H. Clevenger. Eng. and Min. J., 1916,
102, 579—582.

Precipitation by electrolysis is less complete than by chemical methods, and it is found more economical to complete the precipitation in zinc boxes than to attempt complete precipitation by electrolysis. It is essential to subject the electrolyte to agitation or rapid movement. Peroxidised lead is the most satisfactory anode material (this J., 1915, 1095). Fused magnetite electrodes are fragile. The cathodes used are made of sheet lead, tin plate, or aluminium. The electrode surface is very large, necessitating unwieldy units as compared with zinc-boxes. The electrolyte is a poor conductor owing to the small proportion of dissolved salts; hence the electrodes must be placed close together, but less than 1½ in. space has not been found practicable. Electrolysis is most advantageous where there is a considerable bulk of metals to precipitate, where much copper is present, and where thiocyanate is formed during cyaniding, as this salt is then again converted into cyanide.—W. R. S.

Brass; Heat treatment of — in neutral and reducing atmospheres. Use of coal gas. A. H. White and B. A. Standerline. Michigan Gas Assoc. J. Gas Lighting, 1916, 136, 136—138.

SPIRALS of thin copper and brass foil were heated in neutral and reducing atmospheres in a muffle within which coal gas was burnt with an insufficient supply of air, the combustion being completed with additional air outside and around the muffle. To effect combustion, it was necessary to preheat the mixed gases by passing them through a previously heated chequer-work of refractory material (see also this J., 1915, 1094). Copper was not oxidised when heated to 1200° F. (650° C.) in a mixture of 3 vols. of air and 1 vol. of gas, but smaller proportions of air were necessary at higher temperatures. The volatilisation of zinc from brass was reduced to a minimum by rapid heating. The loss of zinc brought about by heating brass containing 70% Cu and 30% Zn almost at the melting point for an hour amounted to an elimination of zinc from a layer only 0.003 inch thick. With lower temperatures, more favourable results were obtained. Tests have only been made on the laboratory scale, but it is considered that with proper furnace design, the process should be successful for annealing brass on the large scale.

—T. ST.

Brass; Effect of corrosion on the ductility and strength of —. P. D. Merica. U.S. Bureau of Standards. Met. and Chem. Eng., 1916, 15, 321—324. (See also this J., 1915, 1057.)

THE strength and ductility of brass are known to

be decreased as the result of corrosion (in ammonia solution) while under stress. In seeking an explanation of this, measurements were made of the electrolytic potential of brass, two similar electrodes of which, one under stress and the other not, were used in dilute solutions of copper and zinc sulphates under conditions precluding atmospheric oxidation of the alloy. Rods of a-brass (nominally Cu 67.5 and Zn 32.5%, but containing Pb 0.06 and Fe 0.02%), 0.25 in. in diameter, were employed after being annealed at 400° C. for 1 hr., cleaned by light rubbing with fine emery, and then etched with nitric acid. From the results obtained it is believed that an increase in e.m.f. of a-brass is caused by the application of tensile stress, the increase amounting to about 0.2 millivolt at 20,000 lb. per sq. in. (below the elastic limit) and to about 1 millivolt at 30,000 lb. per sq. in. (the yield point) of the alloy. On this basis it is suggested that, at the bottom of small furrows in the roughened (etched) surface of the alloy, the stress is greater than at ridges immediately adjacent, with the result that a galvanic couple is formed and that only the bottom of the furrow is corroded; in time a crack is produced, the furrow becoming narrower and sharper as it penetrates inwards, until the cross-section of the material is finally so reduced that fracture occurs.—W. E. F. P.

Brass; Physical tests on common — taken parallel and at right angles to the direction of rolling. W. B. Price and P. Davidson. Amer. Inst. of Metals, Sept., 1916. [Advance proof.] 32 pages.

Tests were made on specimens of brass (Cu 64.71, Zn 35.27, Fe 0.02%; Pb, nil) cut out respectively parallel and at right angles to the direction of rolling. Up to 35% reduction by rolling, the elongation for both directions was practically identical; with greater reduction, transverse specimens showed marked superiority, the effects of rolling becoming strongly evident under the microscope. The tensile strength was nearly the same up to about 50% reduction, beyond which the transverse specimens were again superior. The yield-point was practically the same for both specimens below 20% reduction. With greater reduction the yield point for the longitudinal specimens rose uniformly, until at 42% it was equal to the tensile strength. The yield points of the transverse specimens were more erratic. The longitudinal pieces showed greater reduction of area than the transverse specimens. Above 40% reduction, transverse specimens showed a shrinkage after heating to 300° C. and cooling, while the longitudinal specimens showed elongation.—W. R. S.

Aluminium bronze with 10% aluminium; Thermal treatment of —. A. Portevin and G. Arnou. Rev. Mét., 1916, 13, 101—115.

Two bronzes containing respectively Cu 89.84, Al 9.95, Mn nil, Zn 0.11%, and Cu 88.80, Al 10.02, Mn 1.11, Zn 0.05%, having been rolled into plates 10 mm. thick, were heat-treated and then subjected to tensile, impact, and hardness tests, and micrographic examination. The influence of the quenching temperature was studied by heating specimens in a salt bath for 5 minutes at 500°, 600°, 700°, and 800° C. respectively, and quenching at these temperatures. Quenching at 500° C. did not affect the mechanical properties of the annealed metal (this accords with the fact that the eutectoid point lies between 550° and 600° C.); quenching at 600° and 700° C. raised the values of all the mechanical characteristics, but quenching at higher temperatures, whilst further increasing the tensile strength and hardness, caused a reduction in the elongation and resilience. The influence of reheating after quenching at 800° C. The spec-

mens were heated at 800° C. for 10 minutes, quenched, and then reheated for 10 minutes at 400°, 500°, 600°, and 700° C. respectively. Annealing at 400° C. raised the hardness and tensile strength, and produced a slight corresponding diminution of the elongation and resilience. Annealing at 500° and 600° C. produced rapid changes in the mechanical properties, particularly in the case of the bronze with 1% Mn. Annealing at about 600°–700° C. after quenching, produced a marked improvement in the mechanical properties, as compared with those of the completely annealed rolled metal (1½ hours at 750° C.). Influence of reheating after quenching at 900° C. The previous results were accentuated. The bronze with 1% Mn, when annealed at 600° to 700° C. after quenching at 900° C., gave a higher tensile strength, twice the elongation, and four times the resilience of the fully annealed metal. The α -constituent disappeared with rising quenching temperature, until after quenching at 900° C. the alloy consisted wholly of a martensitic constituent. Reheating after quenching at 800° C. brought about the separation of the α -solid solution, in that the dimensions of the α -elements persisting after quenching were increased, and needles separated between these elements. On reheating after quenching at 900° C. the needles became more and more clearly defined and numerous as the reheating temperature was increased.—T. ST.

Zinc bronze: 2Zn-10Sn-88Cu; Report on a series of comparative tests of—standard test bars. C. P. Karr. Amer. Inst. of Metals, Sept., 1916. [Advance proof.] 12 pages. (See also this J., 1914, 1012.)

In order to obtain further information for framing specifications, tests were made on cast-to-size test bars cast by five foundries from ingots compounded by one of them. The specific gravity of the sand-cast metal averaged 8.50, that of chill-cast metal, 8.69. Re-melting did not materially alter the chemical composition. The results of the physical tests and the suggested standard for specifications are tabulated below.

| | Tensile strength. Lb. per sq. in. | Elongation on 2 in. | Reduction of area. |
|------------------------|--------------------------------------|------------------------|-----------------------|
| Virgin melt | 39,200 ± 1960 | 13 ± 2.3 | 10 ± 3 |
| Do, chill-cast | 44,100 ± 2900 | 28 ± 3 | 23.7 ± 1.3 |
| Re-melted sand-cast .. | 35,300 ± 3500 | 10.5 ± 2.6 | 9.1 ± 2.8 |
| Do, chill-cast .. | 44,300 ± 2900 | 24.6 ± 7.4 | 19.8 ± 7.4 |
| Re-melted { sand-cast | 37,900 ± 2600 | 10.5 ± 2.2 | 11.5 ± 3.2 |
| twice { chill-cast | 31,600 ± 3600 | 4 ± 0.7 | 6 ± 1.9 |
| Suggested { sand-cast | 33,000 | 10 | 9 |
| standard { chill-cast | 40,000 | 22 | 18 |

—W. R. S.

Copper-aluminium-iron alloys; Some —. W. M. Corse and G. F. Comstock. Amer. Inst. of Metals, Sept., 1916. [Advance proof.] 16 pages.

The aluminium content of the alloys tested was 7–10%, and the upper limit of the iron 8%. With constant aluminium percentage there was always an increase in proportional limit, yield point, and tensile strength as the iron increased, with a less substantial decrease in elongation and reduction of area. With constant iron content, the proportional limit, yield point, and tensile strength increased with the aluminium, while elongation and reduction of area decreased. For a given strength, better ductility could be obtained with low aluminium and high iron than vice-versa. Above 4% of iron the ultimate strength did not change much while the ductility fell decidedly. The best alloys for strength and ductility con-

tained between 3 and 4% of iron. Twelve photomicrographs are reproduced and described.

—W. R. S.

Metals; Rates of solution of—in ferric salts and in chromic acid. R. G. van Name and D. U. Hill. Amer. J. Sci., 1916, 42, 301–332.

MEASUREMENTS have been made of the rates at which different metals, such as cadmium, iron, nickel, tin, copper, silver, and zinc, react with the same oxidising solution in the presence of varying concentrations of free acid. The solutions used were (a) ferric sulphate and sulphuric acid, (b) ferric chloride and hydrochloric acid, and (c) chromic and sulphuric acids. When the acidity is sufficiently high, a number of metals give the same reaction velocity under like conditions, showing that diffusion is here the determining factor. With decreasing acidity such agreement tends to disappear, and the observed velocities then depend upon the nature of the metal, the order being approximately the same as in the electro-motive series, and the velocity greater the more electro-positive the metal. The speed of the reaction in normal cases is proportional to the concentration of the oxidising agent, not only under conditions where different metals give the same rate, but also where the rate depends upon the specific nature of the metal. From these and related facts, the following conclusions have been drawn in normal cases, where the progress of the reaction is not interfered with by mechanical effects, such as the formation of insoluble coatings and the like. (1) The velocity of a reaction at the actual boundary surface between a solid and a liquid is not necessarily extremely rapid, even when there is no mechanical interference with its progress. (2) When a solid reacts with a dissolved reagent, and the reaction velocity at the boundary surface is limited, a balance is quickly established between the consumption and the supply (by diffusion) of the reagent, such that its concentration at the boundary, under otherwise constant conditions, is always proportional to its concentration in the solution. (3) The rate of the reaction at the boundary surface may in some cases be low enough, compared with the rate of the diffusion process, to be an important or even the predominant factor in determining the observed reaction velocity. A sound interpretation of the diffusion theory must take account of this possibility, which has heretofore been neglected.—B. N.

Board of Trade Committee on non-ferrous metal trades.

THE President of the Board of Trade has appointed:—Sir Gerard Muntz, Bart. (chairman), Mr. C. L. Budd, Mr. Clive Cookson, Mr. C. W. Fielding, Lieut.-Col. A. J. Foster, Mr. A. W. Tait, and Mr. A. H. Wiggin, J.P., to be a Committee to consider the position after the War, especially in relation to international competition, of the lead, copper, tin, and such other of the non-ferrous metal trades as may be referred to the Committee, and to report what measures, if any, are necessary or desirable in order to safeguard that position. The Secretary of the Committee is Mr. James F. Ronca, to whom all communications should be addressed at 7, Whitehall Gardens, S.W.

Oil-water emulsions; Surface tension of—. A flotation theory. G. Belchic and R. O. Neal. Min. and Eng. World, 1916, 45, 487–489.

In investigating the assumption of various workers that oil reduces the surface tension of water and thus allows air bubbles to exist when they reach the surface of the water in the flotation machine, measurements were made of the surface tensions of oil and water emulsions prepared in a flotation machine of the Minerals Separation type, in which

1 to 5 grms. of 12 different oils and products were agitated for 7 mins. with 2000 grms. of neutral, acid, and alkaline water; the determinations were made by the capillary method. Although scarcely affected by the addition of sodium hydroxide (2 lb. per ton), the surface tension of neutral water, originally 89, was reduced to 60 by a similar proportion of sulphuric acid. Each of the oils also reduced the surface tension of neutral water, but no relation was found to exist between the amount of this reduction and the surface tension of the oil itself. The surface tension of acid water was either increased or decreased by the smaller additions of oil; but except in the case of olive oil, the larger additions caused a decrease in surface tension. The surface tension of alkaline water was increased by the larger quantities of certain oils, but generally unaffected by the smaller proportions. From the fact that the ability of the oils to produce a persistent bubble foam appeared to be independent of surface tension, it is concluded that, for flotation purposes, the foaming power of an oil is more important than its property of decreasing the surface tension of water.

—W. E. F. P.

Mineral output of British India in 1915. Board of Trade J., Oct. 26, 1916.

THE Report for 1915 of the Chief Inspector of Mines in India contains the following particulars relative to the mineral output of British India last year:—There was a distinct advance in the output of coal, which amounted to 16,352,480 tons, an increase of 624,849 tons on the 1914 output. Of the 1915 total 95.93 per cent. was raised in Bengal and in Bihar and Orissa. The output of mica again decreased, and was the smallest since 1910, being only 24,063 cwt. as against 38,139 cwt. in 1914. Restrictions on export and the loss of the German market had an adverse effect on the sale of all grades of splittings. The chief demand was for good clear and part-stained block mica, for use, among other things, for the magnetos of aeroplanes. The trade in Madras mica was especially depressed. The manganese industry was very depressed during the first half of the year, and although there was a strong demand later, the shortage of tonnage prevented it from being fully met. The output of manganese was 378,172 tons, a decrease of 177,500 tons as compared with the 1914 production. The gold output of 1915 was 24,320 oz., as compared with 19,873 oz. in 1914. An output of 512 oz. silver is also reported from a gold mine; this is the first time that silver has figured in the records. The output of copper was 8010 tons, as compared with 4400 tons in 1914. During the greater part of the year the wolfram industry languished, but towards the close, efforts were successfully made to stimulate the production, resulting in a total output for the year of 39,432 cwt. as against 31,526 cwt. in 1914. There were increases in the output of bauxite, clay, fullers' earth, salt, magnesite, and galena, and decreases in iron, chromite, tin, steatite, samarskite, slate, and limestone. The limestone trade has suffered owing to building operations being reduced.

Mineral output of South Africa in 1915. Board of Trade J., Oct. 26, 1916.

ACCORDING to the Report of the Government Mining Engineer, the total value of the mineral output of South Africa in 1915 is estimated at £43,531,000, a decrease of approximately £1,800,000 as compared with the value of the output in 1914. The decrease is more than accounted for by the decline of over £5,000,000 in the value of diamonds produced in 1915. The value of the gold output increased by nearly £3,000,000, whilst the value of copper, tin, and asbestos produced increased by approximately £400,000.

Design of acid-resisting iron apparatus. Swindin. See I.

New application of blast-furnace gas. Zimmermann. See. IIA.

PATENTS.

Iron or steel; Apparatus for determining the "critical" or "conversion" point of samples of — by measuring the electrical resistance of a test piece of such metal whilst heated to a high temperature. H. J. C. Simson, London. From P. Saldau, Petrograd. Eng. Pat. 12,993, Sept. 10, 1915.

A PORCELAIN tube, fitted at both ends with detachable water-cooled extensions, is heated in an electric furnace, and a sample of iron or steel is held within the tube by a gripping device consisting of rods of nickel or nickel-chrome steel. The rods are suitably insulated and their ends, which extend from the tube, are water-cooled and connected with an electrical-resistance measuring apparatus. The temperature of the test specimen is measured by a thermo-couple. Means are provided for passing an inert gas through the tube, or for creating a vacuum therein. The varying resistance is plotted against temperature, the curve indicating by a modification of its shape the critical point of the sample.—T. St.

Steel; Process for casting — in several layers. A. Rojekof, Bejitz, Russia. U.S. Pat. 1,197,859, Sept. 12, 1916. Date of appl., Aug. 12, 1911.

THE mould is divided into two or more compartments by metal partitions which do not touch the walls of the mould. The partitions are made of such a thickness that they weld perfectly with the adjacent layers of molten steel, and are provided with means to facilitate their fusing with the steel. An ingot comprising different layers of steel is formed by charging the several compartments simultaneously with molten steel of different chemical composition.—T. St.

Heat treatment of iron and other metals by means of a reducing gas. Bunzlauer Werke Lengersdorf und Co., Bunzlau. Ger. Pat. 293,798, Oct. 20, 1915.

THE metal is heated by means of a current of hot gas, the composition and temperature of which are controlled by addition of regulated quantities of cold gas produced in the same gas generator (see Fr. Pat. 422,699 of 1910; this J., 1911, 529).—A. S.

Furnace; Electric —. Steel furnace. J. L. Dixon. Detroit, Mich. U.S. Pats. (A) 1,198,625 and (B) 1,198,626, Sept. 19, 1916. Dates of appl., (A) Apr. 10 and (B) July 15, 1916.

(A) THE furnace is provided with a lower electrode and two or more groups of three upper electrodes, with main leads for supplying three-phase alternating current to transformers in groups of three, corresponding in number with the upper electrodes. One terminal of each secondary is connected to one of the upper electrodes, and the other secondary terminals are connected in common to the lower electrode. The primaries of one or more of the three-transformer groups are connected by conductors to the main leads in triangular fashion, and the remaining primary groups by conductors in star fashion. Two or more sets of multiple switches are arranged to reverse the terminal connections of one primary in each group connected in triangular fashion, with relation to two of the main leads, whilst also reversing the terminal connections of one primary in each star-connected group with respect to the interior or common connection of the star. (B) The upper electrodes are arranged in pairs in the furnace, which is provided

also with a lower electrode, and three-phase alternating current is supplied from main leads to one or more transformers, the secondaries of which are connected so as to deliver two-phase currents to all but one pair of the upper electrodes. An additional transformer, delivering two-phase current from two secondaries, is connected with the main leads, with connections from the terminals of one of the secondaries to one of the remaining upper electrodes, and similar connections, arranged in two reversely-connected branches, between the terminals of the other secondary and the last upper electrode and the lower electrode respectively. Suitable switches are arranged in the two branches of the last-named connections to place the secondaries either in multiple arc or in series.

—B. N.

Silvering and gilding metal articles; Preparations for — A. Dalby, London. Eng. Pats. 8866 and 8867, June 16, 1915.

PREPARATIONS for coating or plating metals such as iron, steel, copper, brass, or aluminium, are composed of equal parts of potassium iodide, potassium hydrogen tartrate, potassium cyanide, and the double cyanide of potassium and silver for silver plating or washing silver or silver-plated articles, or gold chloride for gilding or washing gold or gilded metals. One pint of distilled water is added to 8 oz. of the mixture, or the latter is made into a paste with 4 oz. of calcium carbonate and a few grains of calcium chloride.—B. N.

Metals; Production of granulated or finely divided — J. S. Remington, Grange-over-Sands. Eng. Pats. 13,958, Oct. 1, and 14,853, Oct. 20, 1915.

MOLTEN metal is sucked up a tube from a crucible into an ejector by the action of a jet of steam, air, or gas, delivered under pressure (100 to 200 lb. per sq. in.) through a nozzle into the ejector. The jet picks up the molten metal and delivers it as a fine spray, the particles of which solidify as a granulated powder on coming into contact with the cool air. The gas or steam is strongly heated before coming into contact with the molten metal, by passing it through a coil contained in a hood just over the crucible, the hood serving also to exclude air from the crucible. The method is particularly applicable to the granulation of aluminium.—T. St.

Alloy. P. R. Kuehnrich, Sheffield. Eng. Pat. 14,939, Oct. 22, 1915.

A SUBSTITUTE for high-speed steel for making high-speed tools is composed of ferro-chrome (containing about 70% Cr and 4 to 6% C) 8, Ni 21, Si 1.7, Al 2.5 parts by weight. The base alloy of nickel, chromium, and silicon, is first melted, and the aluminium, ranging from 3 to 20%, according to the hardness required, is then added. The molten alloy is cast into tools, which are ready for use, after grinding, without any additional heat treatment. Metals such as tungsten, vanadium, etc., in proportions up to about 1%, may be added to the base alloy, and the nickel may be wholly or partially replaced by cobalt.—T. St.

Radium; Process of treating ores containing — R. B. Moore, Denver, Colo., U.S.A. Eng. Pat. 18,228, Nov. 17, 1915.

THE liquid obtained by leaching the ore (e.g. carnotite) with a hot solution of nitric acid containing a little hydrochloric acid, is nearly neutralised and then treated with barium chloride and sulphuric acid to obtain a precipitate of radium-barium sulphate.—W. E. F. F.

Ores; Process of treating — R. F. Bacon, Pittsburgh, Pa., Assignor to Metals Recovery Co. U.S. Pat. 1,197,589, Sept. 12, 1916. Date of appl., June 28, 1915.

To enable the constituents of non-sulphide ores to be separated from associated gangue and from each other, by flotation, the finely divided ore is subjected to the action of hydrogen sulphide in the presence of an excess of sulphur dioxide, to produce colloidal sulphur within the mixture and convert the metal compounds present into sulphides.—W. E. F. F.

[Copper-zinc] ores; Concentration of — R. F. Bacon, Pittsburgh, Pa., Assignor to Metals Recovery Co., New York. U.S. Pat. 1,197,590, Sept. 12, 1916. Date of appl., Nov. 10, 1915.

NON-SULPHIDE ore containing metals forming sulphides soluble and insoluble in acid (e.g. zinc and copper, respectively), is treated with excess of acid, followed by hydrogen sulphide. The mixture is then subjected to a flotation process whereby a concentrate rich in acid-insoluble sulphides is obtained; the residual acid pulp is neutralised, treated with alkali sulphide, and then by flotation to recover the acid-soluble sulphides. Sulphide copper ore is partly roasted to convert the sulphides into compounds soluble in acid, then treated with acid and hydrogen sulphide in succession, and finally by flotation to recover the copper sulphide.—W. E. F. F.

Metal; Compound — B. E. Eldred, Assignor to General Electric Co., New York. U.S. Pat. 1,197,615, Sept. 12, 1916. Date of appl., Sep. 18, 1913.

A WIRE having as a whole a lower coefficient of expansion than platinum, is composed of a core of nickel steel, a layer of copper welded to the core, and an exterior sheath of platinum welded to the copper.—T. St.

Ferrous metals; Plating — [with copper]. H. Eldridge, New York, Assignor to The Metals Plating Co. U.S. Pat. 1,197,616, Sept. 12, 1916. Date of appl., Apr. 3, 1913.

FERROUS metal is coated with cupric oxide and heated at substantially the melting point of the cupric oxide for about 4 to 10 seconds, until the iron reacts with the oxygen of the oxide. A substantially continuous coating of metallic copper in a weld-like union is thus formed. The iron oxide formed is superposed on the copper and is finally removed.—T. St.

Metals; Plating — W. E. Watkins, New York. U.S. Pats. (A) 1,197,694 and (B) 1,197,695, Sept. 12, 1916. Date of appl., Aug. 17, 1915. (See also Eng. Pat. 18,932 of 1914; this J., 1916, 53.)

(A) To plate iron or steel with copper, a coating consisting of a reducible compound of copper, a suitable reducing liquid vehicle, a finely divided solid reducing agent, and finely divided particles of copper, is applied, and the metal and coating are heated to so high a temperature and for so long as to form an adherent plating layer of copper. (B) Instead of the coating described in (A), a substantially homogeneous copper-plating suspension, comprising finely divided particles of copper, together with a suitable spreading vehicle of a reducing character, containing finely divided carbon in suspension, is used.—T. St.

[Gold and silver.] Precious metals from their ores; Method of extracting — T. B. Crowe, Victor, Assignor to The Portland Gold Mining Co., Colorado Springs, Colo. U.S. Pat. 1,198,011, Sept. 12, 1916. Date of appl., Mar. 2, 1915.

AIR is blown continuously through a mixture of the finely divided ore and cyanide solution, the

closed containing vessel having a relatively small air outlet so that the mixture is maintained under pressure.—W. E. F. P.

[Gold and silver.] Precious metals from their ores; Process of extracting——A. E. Vandercook, Alameda, Assignor to L. B. McMurtry, San Francisco, Cal. U.S. Pat. 1,198,086, Sept. 12, 1916. Date of appl., Oct. 24, 1914.

A MIXTURE of the ground sulphide ore with alkali cyanide solution is caused to impinge repeatedly on a layer of mercury by which the larger metallic particles are amalgamated. The alkali sulphide formed is decomposed by the mercury-alkali cyanide produced in the solution, mercury sulphide being precipitated and the alkali cyanide regenerated. The precious metals are recovered by the usual methods from the cyanide solution and amalgam.—W. E. F. P.

Metals [gold and silver]; Process and apparatus for extracting——from their ores. Koering Cyaniding Process Co. Fr. Pat. 479,683, Sept. 7, 1915.

WITHIN a closed, horizontal, rotary cylinder a smaller perforated cylinder is fixed co-axially by means of channel irons which divide the annular space between the cylinders into longitudinal compartments. The perforated cylinder, into which the ore and solvent (cyanide solution) are charged, is lined inside with a refractory filtering medium in the form of slabs or tiles, the latter being maintained in position by angle irons disposed longitudinally so as to form a series of narrow shelves along the inside of the chamber, and "caulked" with strips of lime wood or other material adapted to expand when moistened. Means are provided for the admission of air and water or other liquid to the inner and outer cylinders, the arrangement being such that during rotation the solvent is caused to pass repeatedly through the ore and filtering medium in alternately opposite directions before discharge.

—W. E. F. P.

Arsenical material; Process of treating——[for the recovery of zinc]. D. Anderson, jun., San Francisco, Cal. U.S. Pat. 1,198,095, Sept. 12, 1916. Date of appl., Feb. 7, 1914; renewed June 8, 1916.

ARSENICAL ore, flue-dust, etc., containing iron and zinc, is treated with rather more than sufficient sulphuric acid (or gases containing sulphur trioxide) to convert the bases present into normal sulphates, and the mixture evaporated to dryness and heated to expel arsenic. After being roasted at such a temperature that only a small proportion of the zinc is rendered insoluble, the residue is leached with water.—W. E. F. P.

Bearing material and process of producing the same. R. E. Rich, Chicago, Ill. U.S. Pat. 1,198,152, Sept. 12, 1916. Date of appl., Apr. 17, 1915.

MOLTEN Babbit metal is incorporated with particles of graphite, the latter being heavily coated with lead and having a minimum sp. gr. of 6.8; the mixture is allowed to solidify.—W. E. F. P.

Copper-refining. U. A. Garred, New York. U.S. Pat. 1,198,434, Sept. 19, 1916. Date of appl., Apr. 26, 1916.

COPPER is melted and "flapped" in a cupola wherein it is subjected to the action of flaming particles and highly heated products of combustion and air. The molten metal is partially "poled" by being passed over solid carbonaceous material, and is then conducted to a "poling furnace" where it is first blown with air to effect any desired oxidation, and finally with non-oxidising gas charged with finely divided carbon particles to complete the "poling." The molten

"flapped" copper is received from the cupola into a tilting ladle, from which it is delivered alternately to two "poling furnaces" spaced apart.—T. St.

Brass and copper alloys; Process of making——G. H. Clamer, Philadelphia, Pa. U.S. Pat. 1,198,618, Sept. 19, 1916. Date of appl., Feb. 16, 1915.

THE copper is melted, then introduced into an electric furnace, and the alloying materials added, a proper temperature being maintained during the addition to avoid volatilisation; the resulting alloy is finally brought to the proper casting temperature.—B. N.

Brass; Method of obtaining——directly by the use of low-grade zinc ores. M. Pierron. Fr. Pat. 479,599, Aug. 26, 1915.

FINELY-POWDERED low-grade oxidised zinc ore, etc., is heated, preferably in crucibles, with an excess of carbon and copper strips or turnings to 800°–950° C. for 6 to 10 hours, whereby the zinc vapour is absorbed by the copper, without fusion of the product. The copper may thus be converted into brass containing 10 to 20% Zn in one operation. By repeating the operation three or four times, the zinc content may be raised to 40–45%, but to obtain any given exact composition, it is necessary to melt the brass so formed, and make suitable additions of copper or zinc.—T. St.

Vacuum-filter; Rotary——[for use in treatment of ores]. E. Wagner, New York. U.S. Pat. 1,198,880, Sept. 19, 1916. Date of appl., Mar. 13, 1913.

AN apparatus for recovering values from ore solutions consists of a drum made up of two rotary rings, forming two independent compartments, and a number of independent and detachable filtering units attached to the periphery of the drum. Each unit consists of a pan with a grooved perforated bottom on which rests filtering material. Each pan communicates through perforations with both compartments, one of which is connected with a pressure system and the other with a suction system. Two valves are associated with each pan for controlling the communications with the two compartments, and means are provided for automatically actuating the valves during the rotation of the drum. The material to be filtered is fed into the pans from above as the drum rotates.—T. St.

Lead matte; Treating——U. Wedge, Ardmore, Pa. U.S. Pat. 1,198,882, Sept. 19, 1916. Date of appl., Jan. 29, 1913.

LEAD matte is passed through a furnace of the superposed hearth type so arranged that the matte is first gently heated, and later, when a suitable proportion of the sulphur has been removed, strongly heated to complete the desired desulphurisation.—T. St.

Welding [; Flux for——]. C. W. Phelps, Coupeville, Wash., Assignor to D. E. Richardson, Riverside, Wash. U.S. Pat. 1,199,020, Sept. 19, 1916. Date of appl., June 6, 1914.

A FLUX for welding and working iron and steel is composed of volcanic ash 9 parts, and sodium chloride 1 part.—W. F. F.

Zinc and lead; Condenser for vapours of——Soc. Anon. Métallurgique "Procédés de Laval." Fr. Pat. 478,942, June 7, 1915.

THE bottom of a vertical condenser is closed by a conical member which forms part of a rotary, sand-sealed receiving chamber and supports one or more shaped but loosely-fitting blocks. By the grinding action set up between the blocks,

the conical base, and the sides of the condenser on rotating the receiving chamber, the globules of metal percolating through the interstices between these members are caused to coalesce and the liquid metal to flow down the conical surface into the chamber beneath.—W. E. F. P.

[Lead-zinc] ores; *Process for the treatment of low-grade, complex* ——. H. E. L. Flévet. Fr. Pat. 479,039, June 15, 1915.

Low-GRADE, complex ore not amenable to concentration by ordinary methods and containing, for example, lead, zinc, arsenic, antimony, and precious metals, is mixed with oxide and sulphide ores of iron and a little copper (ore or scrap), and the mixture smelted with iron slag, in a water-jacketed urnace, to produce a matte containing all the metals in question. The matte is tapped into a converter and "blown" in the presence of powdered coke to eliminate the more volatile metals, which are recovered as oxides or sulphates, in condensing chambers, and leave a matte rich in copper and containing the precious metals.—W. E. F. P.

Metal alloys; Fusion of ——. A. Hermansen. Fr. Pat. 479,757, Sept. 17, 1915.

IN the manufacture of alloys (e.g. brass) composed of volatile and non-volatile metals, loss by volatilisation is prevented by melting the non-volatile constituents together at a higher temperature than usual and adding the volatile metals after the charge is removed from the furnace.—W. E. F. P.

Ores; Two-stage process for the treatment of ——. Westdeutsche Thomasphosphat-Werke Ges., Berlin. Ger. Pat. 294,119, May 20, 1914.

THE ore is first smelted in an electric furnace, with exclusion of air, or in a reducing atmosphere, and the reduced material is separated from the slag and transferred to a fuel-fired furnace, reverberatory furnace, or converter for further treatment.—A. S.

Steel; Manufacture of ——. by the basic open-hearth process. A. E. Davies, Bilston. U.S. Pat. 1,198,827, Sept. 19, 1916. Date of appl., Sept. 21, 1915.

SEE Eng. Pat. 20,582 of 1914; this J., 1915, 874.

Manganese-steel; Heat treatment of ——. Manganese Steel Rail Co. Fr. Pat. 477,880, Mar. 4, 1915. Under Int. Conv., Apr. 17, 1914.

SEE U.S. Pat. 1,123,003 of 1914; this J., 1915, 181.

Coatings of copper upon iron and steel; Process for obtaining adhesive ——. S. O. Cowper-Coles, London. U.S. Pat. 1,198,703, Sept. 19, 1916. Date of appl., Aug. 24, 1914.

SEE Eng. Pat. 25,393 of 1913; this J., 1914, 793.

Metals from their ores; Apparatus for the recovery of ——. Koenig Cyaniding Process Co., and B. R. Koenig, Detroit, Mich., U.S.A. Eng. Pat. 12,137, Aug. 23, 1915.

SEE U.S. Pat. 1,163,828 of 1915; this J., 1916, 184.

Roasted ores; Process and apparatus for the treatment of ——. with liquids. A. Ramén. Fr. Pat. 477,906, Mar. 5, 1915. Under Int. Conv., Mar. 17, 1914.

SEE Eng. Pat. 15,254 of 1915; this J., 1915, 838.

Metallurgical furnaces. I. Hall. Fr. Pat. 478,158 Mar. 26, 1915. Under Int. Conv., Mar. 23, 1914

SEE Eng. Pat. 7238 of 1914; this J., 1915, 556.

Metals; Electrical deposition of ——. by fusion, and electrodes therefor. Slaughter and Co., Ltd. Fr. Pat. 478,247, Apr. 3, 1915. Under Int. Conv., June 3, 1914.

SEE U.S. Pat. 1,144,390 of 1915; this J., 1915, 838.

Sulphide ores; Separation of mixed ——. Minerals Separation, Ltd. Fr. Pat. 478,478, Apr. 22, 1915. Under Int. Conv., May 1, 1914.

SEE Eng. Pat. 5050 of 1915; this J., 1916, 639.

Concentration of ores. Minerals Separation, Ltd. Fr. Pat. 479,719, Sept. 11, 1915. Under Int. Conv., Sept. 16, 1914.

SEE Eng. Pats. 19,855 and 19,856 of 1914; this J., 1916, 184.

Volatile metals, especially zinc; Manufacture and condensation of ——. in the electric furnace. A/S. Metallforedling. Fr. Pat. 478,770, Jan. 27, 1915.

SEE Ger. Pats. 289,493, 290,490, 290,690, and 291,492 of 1914; this J., 1916, 427, 606, 695.

Ores; Process of smelting ——. and electric furnace therefor. F. W. Highfield. Fr. Pat. 478,778, May 21, 1915.

SEE Eng. Pats. 4937 of 1914 and 2728 of 1915; this J., 1915, 720.

Metals from metalliferous materials; Extraction of ——. H. D. Rankin. Fr. Pat. 479,493, Aug. 10, 1915.

SEE U.S. Pat. 1,150,787 of 1915; this J., 1915, 968.

Protective coatings of alloys for metal articles, and process of applying the same. C. Mark. Fr. Pat. 479,509, Aug. 13, 1915.

SEE U.S. Pat. 1,155,317 of 1915; this J., 1915, 1151.

Process for forming a metal coating upon cement-mortar, plaster-mortar, or gypsum-mortar, trass-mortar and the like, with or without admixture of sand, granite, marble, and the like. Eng. Pat. 14,226. See IX.

Antimony compounds for treatment of parasites and parasitic diseases of plants [and extraction of antimony from metallurgical products]. Fr. Pat. 479,097. See XIXB.

XI.—ELECTRO-CHEMISTRY.

Lead accumulator; Theory of the ——. C. Féry. Jour. de Phys., 1916, 21. Amer. J. Sci., 1916, 42, 366—368.

THE behaviour of the lead accumulator while discharging is stated to be similar to that of a primary cell, such as the manganese cell, with a solid depolariser, with the difference that the negative electrode gives rise to an insoluble salt. The theory of "double sulphating" is stated to be incorrect, and the reaction during normal discharge is given by the equations: $\text{Pb} + \text{H}_2\text{SO}_4 + \text{Pb}_2\text{O}_7 = \text{PbSO}_4 + \text{H}_2\text{O} + 3\text{PbO}_2$, or $\text{Pb} + \text{H}_2\text{SO}_4 + \text{Pb}_2\text{O}_7 = \text{PbSO}_4 + \text{H}_2\text{O} + 2\text{PbO}_2$. These equations show a formation of 15 and 10.4 grms. of the higher oxide per ampere-hour respectively, and the best commercial tests have given 12 to 14 grms. for thin plates slowly discharged. The quantity of acid combined during the discharge is exactly one-half of the amount required by the theory of "double sulphating," and the variations in mass of the

positive plate are very small and are in the opposite sense to those required by the theory. If the formula Pb_2O_3 is accepted, the mass of lead in the positive electrode must be exactly double that taking part in the reaction in the negative grid; the active material of the positive plate is reduced to lead peroxide during the discharge.—B. N.

PATENTS.

Electrolysers; Bi-polar electrode——. G. G. Hepburn, Manchester. Eng. Pat. 12,730, Sept. 6, 1915.

THE electrodes are suspended, face to face, by means of insulating collars on an insulating bolt, so as to form narrow vertical adjustable cells, open at the top and bottom, between the electrodes. These spaces are closed at the side by walls formed of insulating material fixed in vertical grooves in the electrodes. Portions of the upper part of each electrode are cut away, so that a trough is formed above each narrow cell. The lower end of each of the narrow cells is partially closed by a movable bar or wedge, and parallel grooves are cut in the electrodes on each side of these to prevent passage of the electrolyte from one cell to another. Electrolyte is delivered continuously to the upper troughs, and falls in sheets through the vertical cells for treatment.—B. N.

Electrolytic apparatus. W. E. Greenawalt, Denver, Colo. U.S. Pat. 1,198,024, Sept. 12, 1916. Date of appl., Dec. 14, 1911; renewed May 11, 1916.

HORIZONTAL cathodes are arranged within a tank containing the cathode electrolyte, and an anode bell, containing horizontal anodes and anode electrolyte, and closed below by a diaphragm, is suspended within the tank and oscillated by suitable means. Means are also provided for separately introducing and withdrawing the anode and cathode electrolytes, and for catching and removing the disintegrated anode material. A reagent is introduced into the anode bell to combine with the liberated anions, and the regenerated electrolyte is withdrawn through a flexible outlet attached to the anode bell and passing through the cathode electrolyte and the sides of the cathode tank.—B. N.

Furnace; Electric arc——. C. O. A. Dövre, Notodden, Assignor to Norsk Hydro-Elektrisk Kvaelfstofaktieselskab, Christiania, Norway. U.S. Pat. 1,198,116, Sept. 12, 1916. Date of appl., Apr. 13, 1915.

A SUPPORT, projecting inwards, is fixed to the wall of the furnace, and an adjustable electrode is mounted in the support, the electrode projecting through an aperture, in the wall, of larger diameter than the electrode. The aperture is surrounded by a collar, and a spherical cap is arranged to slide on the collar and electrode, and is pressed by a spring against the collar so as to form a gas-tight joint.—B. N.

Carbon articles; Method of [electrically] heating—in independent units. J. W. Brown, Lakewood, Ohio, Assignor to National Carbon Co., Cleveland, Ohio. U.S. Pat. 1,198,616, Sept. 19, 1916. Date of appl., June 6, 1912.

THE body portion of an electric resistance furnace is formed as a movable receptacle, which is removed from its position for charging and discharging, and is then replaced and connected to the electrodes.—B. N.

Electrodes for electric arc furnaces; Supports for——. Norsk Hydro-Elektrisk Kvaelfstofaktieselskab, Fr. Pat. 478,491, Apr. 23, 1915. Under Int. Conv., Apr. 30, 1914.

SEE U.S. Pat. 1,198,116 of 1916; preceding.

Electric arc furnaces. Norsk Hydro-Elektrisk Kvaelfstofaktieselskab, Fr. Pat. 478,694, May 15, 1915. Under Int. Conv., May 19, 1914.

SEE U.S. Pat. 1,193,882 of 1916; this J., 1916, 971.

Insulating material [from waste paper] and process for producing the same. U.S. Pat. 1,198,028, See V.

Electrolysis of alkali chlorides. Eng. Pat. 101,140, See VII.

Electric furnace. U.S. Pat. 1,198,625. See X.

Electrically indicating the presence of saline, alkaline, and acid impurities in feed water used for steam generators and other purposes. Eng. Pat. 101,387. See XIXb.

XII.—FATS; OILS; WAXES.

Vegetable oils; New sources of——. Z. angew. Chem., 1916, 29, 363.

THE proportion of oil (24%) said to be obtainable from lime (linden) seeds (this J., 1916, 1069) has been under-estimated. Recent determinations gave 9.4% of oil, while very good seeds of *Tilia tomentosa* yielded 12.36% and those of *T. parvifolia* 20.36% on extraction. From the oil extracted from horse chestnuts up to about 80% of an edible oil, which resembles rape seed oil in composition, can be obtained. Official instructions have been issued in Germany that the fat must be extracted from these fruits before they are used for fodder.—C. A. M.

Oil extraction from olives; Utilisation of the residues of——. H. Chevalier. Bull. de l'Agric. Tunis, 1915, 19, 277—283. Bull. Agric. Intell., 1916, 7, 591—592.

THE margins of French olive growers is identical with the *amurca* of the ancient Latins, who used it as a fertiliser and insecticide. It is estimated that about 80,000 metric tons of this product is wasted yearly in France. Analysis by Bertainchand of a sample of margins of sp.gr. 1.150 gave the following results:—Mineral matter, 24.20; potash, 12.43; soda, 0.36; lime, 0.78; phosphoric acid, 0.39; chlorine, 2.52; and nitrogenous substances, 3.98 grms. per litre. The annual loss to the soil from this source would thus amount to 9800 tons of potash, 3200 tons of nitrogenous substances, 600 tons of lime, and 300 tons of phosphoric acid. It is suggested that this waste product should be used either in the form of a powder or a wash to destroy scale insects.—C. A. M.

Oil-seeds derived from American palms; Some new——. G. T. Bray and F. L. Elliott. Analyst, 1916, 41, 298—302.

SEVERAL specimens of oil seeds from South and Central America were examined at the Imperial Institute; the kernels of the seeds or nuts will possibly form valuable additions to the oil seeds now utilised as sources of edible fat. In the case of Babassu and Cohune nuts there is considerable difficulty in extracting the kernels from the nuts on account of the thick hard shells. About 1200 tons of Babassu kernels was exported during 1915. The composition of the kernels and the characters of the fats are given in the following table:—

| | <i>Attalea</i> species. | <i>Attalea</i> <i>Cohune</i> . | <i>Astrocaryum</i> species. <i>A. vulgare</i> . | <i>Acrocomia</i> species. | <i>Acrocomia</i> <i>sclerocarpa</i> . | <i>Maximiliana</i> <i>regia</i> . |
|---------------------------------|---------------------------------------|-----------------------------------|--|------------------------------|--|--------------------------------------|
| Popular or native names. | Bassoba, Babassu, Coco Babassu. | Cohune, Coyun, Cahoun. | Tucan. | Large Panama nuts. | Paraguay kernels. | Gru-gru kernels. |
| Origin. | Brazil. | British Honduras. | S. America. | S. America. | S. America. | W. Indies. |
| Composition of kernels:— | | | | | | |
| Moisture | 4.2 | 4.5 | 6.5 | 7.1 | 6.0 | 6.1 |
| Oil | 87.2 | 65.4—71.6 | 48.6 | 37.6 | 65.2 | 57.0 |
| Characters of oil:— | | | | | | |
| M. pt. | 26° C. | 22°—24° C. | 30.5° C. | — | — | 27° C. |
| Titre test .. | 23° C. | 19.7°—21° C. | 27° C. | — | 21° C. | 24.2° C. |
| Sp. gr. at 100°/15° C. | 0.868 | 0.870 | 0.867 | — | 0.865 | 0.867 |
| Acid value | 5.5 | 1.2—20.4 | 2.9 | — | 26.1 | 3.4 |
| Saponif. value | 249 | 252.4—256.5 | 249 | 250 | 247 | 254—255 |
| Iodine value (Hübl, 17 hrs.) .. | 15.6 | 11.4—13.7 | 11.6 | — | 28.5 | 16.2—21.0 |
| Reichert-Walmy value | 5.8 | 6.8—8.3 | 3.8 | — | 6.5 | 5.7—6.8 |
| Polenke value | 10.2 | 12.5—15.4 | 5.0 | — | 10.2 | 10.0—12.6 |
| Unsaponifiable matter, % .. | 0.3 | 0.2—0.3 | 0.3 | — | 0.3 | 0.4—0.5 |

—W. P. S.

Shark liver oil; A highly unsaturated hydrocarbon in —, M. Tsujimoto. *J. Ind. Eng. Chem.*, 1916, 8, 889—896. (See also Mastbaum, this J., 1916, 316.)

THE hydrocarbon, squalene, present in certain shark liver oils (this J., 1916, 609), could readily be prepared on a commercial scale in Japan by distilling oils containing it under reduced pressure or with superheated steam and then washing the distillate with alkali to remove free fatty acids. The hydrocarbon has $n_D^{20} = 1.4965$, and is readily soluble in ether, petroleum spirit, carbon tetrachloride, and acetone, and sparingly soluble in cold alcohol and glacial acetic acid. When mixed with 1% of cobalt resinate, it dried in about 10 days in winter to a colourless smooth film, firmer than films obtained from fatty oils. The product obtained by complete hydrogenation of squalene is an oil resembling "liquid paraffin," which sets to a transparent jelly at -80°C ., and becomes mobile again at -35°C .—A. S.

Hydrogenation of fatty oils; Problem of catalyst poisons with reference to the —, C. Ellis and A. A. Wells. *J. Ind. Eng. Chem.*, 1916, 8, 886—888.

ONE of the chief difficulties in the hydrogenation of low-grade oils, such as fish and whale oils, is that the nickel catalyst is soon rendered inactive. In some cases the substance which affects the catalyst is absorbed or fixed by the latter, for if the inactive catalyst be removed, the hydrogenation can be readily completed with a fresh quantity of catalyst. Moreover in many cases oils can be purified by agitating with spent catalyst so that hydrogenation can subsequently be readily effected. Of various methods tried for removing the substance or substances which render the catalyst inactive, agitating and heating the oil with freshly precipitated copper hydroxide was found most effective, especially if preceded by treatment with caustic soda or sodium carbonate solution. Satisfactory results in this way were obtained with cod oil, menhaden oil, and herring oil. With dog-fish oil it was necessary to filter off the catalyst after a preliminary treatment, then add a mixture of finely-divided nickel-copper hydroxide, and again treat with hydrogen before satisfactory hardening could be effected.—A. S.

Arachidic acid [arachis oil]; Detection of —, R. H. Kerr. *J. Ind. Eng. Chem.*, 1916, 8, 904.

THE presence of 5% of peanut (arachis) oil in olive

oil, cottonseed oil, soya bean oil, and corn (maize) oil can be detected by the following method. 20 grms. of the oil is saponified with alcoholic potassium hydroxide, and the excess of alkali is neutralised with a 25% solution of acetic acid in 95% alcohol, in presence of phenolphthalein. The mixture is treated with 50 c.c. of a 5% solution of magnesium acetate in a mixture of equal parts of water and 95% alcohol, heated to boiling, cooled to the ordinary temperature, with occasional shaking, and then kept at 10° — 15°C . until next day. The precipitate is filtered off, washed twice with 50% alcohol and three times with water, then treated, in the flask in which precipitation was effected, with 100 c.c. of hot water and sufficient dilute sulphuric acid to decompose the magnesium salts. The separated fatty acids, after washing with water, are dissolved in 90% alcohol, and arachidic acid separated by crystallisation.—A. S.

Marine animal oils in oils, fats, and soaps; Detection of —, J. Marcusson and H. von Huber. *Mitt. K. Materialprüf.*, 1916, 34, 56—60.

PRODUCTS such as "neutraline" prepared by heating marine animal oils in absence of air or in presence of an inert gas, do not respond to the octobromide test (*Mitt. K. Materialprüf.*, 1911, 469), but give a positive result with Tortelli and Jaffé's colour reaction (this J., 1914, 1061; 1915, 1102). They are also characterised by high specific gravity (over 0.930) and high viscosity (from 31.7 to 19.5 Engler degrees at 20°C . in four samples examined). Certain other oils possess high specific gravity and high viscosity, but may be easily recognised, e.g., castor oil by its solubility in alcohol and high acetyl value, "soluble castor oil" (blown castor oil) by yielding a considerable quantity of hydroxy-acids insoluble in petroleum spirit, and lithographic varnish and similar products prepared from linseed oil, by their odour and by the phytosteryl acetate test. Hydrogenated marine animal oils may be detected by examination of the unsaponifiable matter for the presence of octodecyl alcohol of m.pt. 60°C . (Marcusson and Meyerheim, this J., 1914, 491). Clupanodonic acid, the constituent of marine animal oils to which the octobromide reaction is due, is present in small quantities in some oils from terrestrial animals, but in cases where any doubt may arise, recourse may be had to quantitative determination of the amount of octobromide, and to determinations of the iodine values of the oil and of the liquid fatty acids.—A. S.

Suberogenid acids. [Fatty acids from cork.] F. Scuri and G. Tommasi. *Gaz. Chim. Ital.*, 1916, 46, II., 159—168.

THE authors have shown previously (this J., 1913, 542) that the constituent of cork named fellenic acid by Kügler is really α -hydroxybehenic acid. Investigation of the suberitic and floionic acids of Gilson (*La Cellule*, VI., 1890, 63) has now shown that these are respectively ricinoleic acid or an isomer and a saturated tricarboxylic acid of the fatty series, $C_{22}H_{42}(COOH)_3$, m.pt. 121° C. Cork substance must therefore be regarded as a combination of cellulosic and hemicellulosic derivatives with products of the enzymic oxidation of fatty acids.—A. S.

Surface tension of oil-water emulsions. A flotation theory. Belchic and Neal. See X.

Detection of benzoic acid in [edible] fats. Stadlin. See XIXA.

Glycerin as medicine. See XX.

Catalytic hydrogenation of organic compounds with base metals at the ordinary temperature. Influence of contact poisons on hydrogenation. Kelber. See XX.

PATENTS.

Catalysts for hydrogenation processes, particularly for the hydrogenation of fatty acids and their esters; Preparation of—. E. B. Higgins, Wallasey. Eng. Pat. 23,873, Oct. 21, 1913.

FATTY acid salts, such as the formates, of nickel, cobalt, iron, or copper, are heated until the mass blackens, preferably in a vessel from which the air has been expelled by means of nitrogen or other inert gas. The resulting product does not lose its catalytic activity on exposure to the air at ordinary temperatures.—C. A. M.

Cocoa [cacao] butter and the like; Horizontal hydraulic presses for pressing out—. D. T. Hänel, Dresden, Germany. Eng. Pat. 13,188, Sept. 15, 1915.

A HORIZONTAL press constructed on the principle of the upright "pot press," contains a series of annular vessels or hollow pots, which are pressed forward by the piston until a cover plate comes against the end member of the series and closes it, after which the pressing is completed by the telescoping of the hollow pots and plungers in the column. The piston is then drawn back, and the pots are clamped in position whilst uncoupled from the succeeding press plungers, which, when now moved forward again, expel the press-cakes from the hollow vessels.—C. A. M.

Catalysts [for hydrogenation of oils and fats]. N. Sulzberger. Fr. Pat. 478,911, June 4, 1915. Under Int. Conv., Feb. 25 and June 9, 1914. SEE U.S. Pat. 1,143,332 of 1915; this J., 1915, 822.

Process of regenerating [nickel] catalysts. U.S. Pat. 1,199,032. See I.

XIII.—PAINTS; PIGMENTS; VARNISHES; RESINS.

Paints; Effect of storage on mixed—. E. E. Ware and R. E. Christman. *J. Ind. Eng. Chem.*, 1916, 8, 879—883.

MIXED paints to which small quantities of water containing an emulsifying agent have been added

to retard settling of the pigment, may deteriorate on prolonged storage owing to "skinning" or to "puttying." The former term is used here to denote the formation of an amorphous soapy layer between the settled pigment and the supernatant vehicle, and the latter, the gelatinisation of the whole of the paint to a soft, putty-like mass. Several samples of composite-base paints which had been kept for periods varying from two to eight years were examined. The amorphous layer in samples of paints in which "skinning" had occurred, was found to consist chiefly (e.g. to the extent of over 80%) of zinc soap, and its formation is due to combination of the oxides of the pigment with free fatty acids produced by the saponification of the oil of the vehicle by the aqueous emulsifying agent. When dissolved resins formed from added "gloss oil" are present in sufficient quantity, the viscosity of the vehicle is increased to such a degree that the metallic soaps formed and the pigments are prevented from settling, and "livering" or "puttying" takes place. It is suggested that an aqueous emulsifying agent containing a substance which exerts no saponifying action on linseed oil should be used, or a non-aqueous protective colloid, such as aluminium palmitate or oleate, should be added to prevent settling of the pigment. The setting of mixed paints to a hard mass might be prevented by grinding the pigments in an oil of fairly high acid content or by adding the optimum amount of lead or zinc soap to the pigments ground in a neutral oil.—A. S.

Turpentine; Italian—. Oil of turpentine from *Pinus pinea*, L. F. C. Palazzo. *Annali Chim. Appl.*, 1916, 6, 135—153.

TURPENTINE has been collected and distilled on a small scale in Tuscany for the past five or six years, but the production of Italian oil of turpentine is negligible compared with the quantity (about 3000 metric tons per annum) imported, chiefly from the United States and France. Italian turpentine is obtained from *Pinus pinaster* (*P. maritima*) and from *P. pinea*, and the variable character of the product is due to the fact that the two kinds are distilled together indiscriminately, although they yield oils of entirely different characters. The author has examined samples of oil of turpentine distilled in the laboratory with steam at 2½—3 atm. pressure from specimens of the oleoresin of *P. pinea* collected under his personal supervision. The characters of the oil were: sp.gr. at 15° C., 0.8473—0.8507; n_D^{20} = 1.4731—1.4737; n_D^{25} (100 mm.) = —93.80° to —97.30°; flash point (Abel apparatus, with bath at 80° C.), 50°—51° C.; soluble in about 5 vols. of 90% alcohol. On fractional distillation the oil yielded 85—90% distilling between 174° and 180° C., and this fraction was found to consist almost entirely of limonene. The pure limonene obtained from it by distilling in presence of sodium and again fractionating, had the characters: b.pt., 175°—176° C.; sp.gr. at 20°/15° C., 0.8432; n_D^{20} = 1.4720; n_D^{25} = —120.36. It is urged that the production of oil of turpentine from *P. pinea* should be developed in Italy, as the oil, apart from the advantages it possesses in many respects over ordinary oil of turpentine, is of value as a commercial source of limonene, which is largely used in the manufacture of artificial essential oils and scented soaps and as a solvent in the varnish industry.—A. S.

Kauri-gum industry of New Zealand in 1915-16. Board of Trade J., Oct. 26, 1916.

THE second annual Report of the Superintendent of the Kauri Gum Industry in New Zealand states that shortly after the declaration of war there was a decided slump in the industry, and in order to

alleviate the depression the New Zealand Government passed an Act in 1914 which empowered the Minister of Land to buy and sell gum. The original intention was to advance up to 50% of the value of the gum on the basis of prices current on 1st July, 1914, and when the gum was sold to hand over to the producer the proceeds less the amount advanced and all charges incurred in connection with the handling of the gum. Later it was arranged to make a further advance of 20%, and finally, by an amending Act in 1915, the Minister was empowered to make purchases outright, the probability being that all future purchases will be so made. The Act of 1914 referred to above also authorised the Minister of Lands to employ workmen on the Crown gum lands. This was given effect to, and the system known as "face-digging" was put into operation. The special feature of "face-digging" is that while recovering gum from the surface of the ground the surface is levelled and made suitable for subsequent farming operations. Wherever it is practicable stumps are removed in the process of digging operations, as is also loose timber, for it is under the stumps that the large deposits of gum are often found. For the profitable carrying on of this work it will be necessary to obtain some mechanical appliance for dealing with the timber, not only in order to remove it from the ground, but also to facilitate its disposal. Much consideration has been given to the possibility of extracting gum from this timber. Gum is also collected by tapping kauri trees. It is said that it is possible to bleed the kauri without doing any appreciable injury to the tree, and it is estimated that for every million feet of milling lumber in a forest a net annual revenue of £75 could be obtained by the tapping process. The fossil kauri gum when taken from the ground is scraped with a strong pocket knife in order to clean it. Some better method of cleaning is necessary, and a sand-blast apparatus of local invention seems to promise good results. An experimental plant equipped at Auckland proved successful, and a factory was afterwards erected in Dargaville to clean gum for the market. The quantity of gum exported in 1915 was 4575 tons, valued at £279,138, as compared with 8473 tons, valued at £497,444, in the previous year. From 1st January to 30th June in the current year, however, 2644 tons of gum, valued at £104,291, was exported. Latterly there was little or no demand for Government advances owing to the fact that local merchants were buying freely and at good prices. The United States not only takes by far the greatest proportion of the kauri-gum output of New Zealand, but also the most expensive grades. The gum exported to the United Kingdom includes a considerable proportion of low-grade chips and dust used in linoleum manufacture. Considerable attention has been directed lately to the question of the profitable utilisation of kauri-swamp peat by the extraction of oils and other valuable products, and two syndicates have carried out a large amount of preliminary investigation work in connection therewith.

Formation of cobalt aluminate, cobalt orthostannate, and Rinman's green. Hedvall. See VII.

PATENTS.

Paint for general purposes; Composition of matter to be used as a —. N. B. Arnold, Brooklyn, N.Y., U.S.A. Eng. Pat. 101,365, Feb. 8, 1916. (Appl. No. 1860 of 1916.)

A PAINT which has good covering power and does not crack or peel when dry is obtained by incorporating zinc oxide (300 lb.) with silica (75 lb.) and linseed oil (9 galls.).—C. A. M.

Paint composition. B. T. Brooks and F. W. Padgett, Assignors to Gulf Refining Co., Pittsburgh, Pa. U.S. Pat. 1,197,599, Sept. 12, 1916. Date of appl., Aug. 10, 1914.

THE pigment is incorporated with an unsaturated, non-saponifiable, non-volatile hydrocarbon which will yield a film on drying.—C. A. M.

Crayons, pencils, or masses; Phosphorescent or luminous —. Self-luminous pencils or crayons. W. C. Horne, North Cheam, Eng. Pats. (A) 16,518 and (B) 16,519, Nov. 23, 1915.

(A) PHOSPHORESCENT calcium sulphide prepared as described in Eng. Pat. 805 of 1881, or commercial "luminous sulphide of calcium" is digested with a mixture of water and alcohol until the lime present is completely slaked. It is then incorporated with a mixture of soap with spermaceti, lanoline, or an oil such as castor or almond oil, with or without crystalline sodium phosphate, and the warm mass is moulded into crayons, which will remain permanently soft. The calcium sulphide may be replaced by phosphorescent zinc sulphide, which should be moistened with alcohol before compounding with the other ingredients. (B), Luminous pencils which do not require exposure to light are prepared by mixing a radioactive substance such as commercial radium bromide (30 grains) with a "screen element" such as zinc sulphide or the like (90 grains), and incorporating the mixture with a fatty or soapy medium such as an alcoholic solution of pure potash soap or a chloroform solution of wax, or both; or the active ingredient may be mixed with gum, or with a finely powdered resin, and the mixture formed into a mass by pressure and heat.—C. A. M.

Mimeograph inks, and process of making same. R. Hochstetter, Assignor to The Ault and Wiborg Co., Cincinnati, Ohio. U.S. Pats. (A) 1,198,440, (B) 1,198,441, and (C) 1,198,442, Sept. 19, 1916. Date of appl., Feb. 4, 1914.

(A) A CARBON black pigment is ground with a mineral oil, with or without the addition of a small proportion of a blue pigment, and the mixture is incorporated with Turkey-red oil or other sulphonated oil. (B) A coloured pigment or lake colour is used instead of the black pigment specified in (A). (C) A dyestuff of the desired colour, or its base, is dissolved in alcohol, an acid capable of forming oil-soluble colours, and a small proportion of a solvent for basic aniline dyestuffs are added. The solution is ground with a mineral oil, with or without the addition of another pigment, and Turkey-red oil is added to the mixture.—C. A. M.

Wooden articles; Superficial finishing of —. E. S. Buffum, Newton, Mass. U.S. Pat. 1,197,601, Sept. 12, 1916. Date of appl., Sept. 3, 1912.

THE surface is treated with melted rosin or other filling material until air and moisture have been expelled from the pores. The rosin is then allowed to harden, and the surface is coated with a phenol-resin varnish or other "convertible varnish," and, after drying, is heated at a temperature below the melting point of the rosin, until the resinous constituent of the varnish has become hardened.—C. A. M.

Clarifying agents from the nitro-derivatives of resins, balsams, or their constituents. C. Bauer. Ger. Pat. 292,542, Nov. 3, 1914.

NITRATED colophony, resin, balsam, etc., may be used for clarifying turbid aqueous liquids. The nitro-derivatives are ground very finely with a small quantity of water or dissolved in a solvent

miscible with water, or in alkali hydroxide or carbonate solution, before being added to the solution to be clarified. When alkaline solutions are used, a precipitant, *e.g.* an acid, or a salt such as lead acetate or alum, is also added. When used for clarifying alimentary products, such as gelatin solutions, the nitro-derivatives must first be freed from bitter substances by dissolving in excess of alkali hydroxide or carbonate solution and heating until saponification begins. *Example*: A solution of 100 grms. of dextrin in 300 grms. of water is stirred in the cold with 5 c.c. of a solution containing 10% of nitrated resin and 90% of alcohol, filtered, and concentrated if necessary; the solution will remain clear.—F. W. A.

XIV.—INDIA-RUBBER; GUTTA-PERCHA.

PATENTS.

Vulcanised rubber and the like; Process for regenerating — B. J. F. Varenhorst, The Hague, and J. G. Fol, Delft, Holland. U.S. Pat. 1,198,975, Sept. 19, 1916. Date of appl., May 4, 1914.

THE material is finely divided, boiled in an alkaline solution, and heated, with constant agitation, in an atmosphere of an inert gas to a temperature close to but below the melting point.—C. A. M.

Rubber; Process for moulding vulcanised — J. D. Mundi. Fr. Pat. 479,543, Aug. 17, 1915. Under Int. Conv., Feb. 23, 1915.

VULCANISED rubber waste, broken up or powdered, with or without the addition of raw rubber, is submitted to high pressure and raised temperature whilst in moulds or suitable moulding machinery.—F. C. T.

Rubber and analogous substances; Treatment of — Rubber Regenerating Co. Fr. Pat. 479,785, Sept. 20, 1915.

SEE U.S. Pat. 1,158,843 of 1915; this J., 1915, 1261.

Vulcanised plastic material; Manufacture of articles of — Rubber Regenerating Co. Fr. Pat. 479,806, Sept. 22, 1915.

SEE U.S. Pat. 1,161,967 of 1915; this J., 1916, 130.

XV.—LEATHER; BONE; HORN; GLUE.

Tannin contents of some Queensland barks. J. C. Brünich and A. T. Jefferis. Queensl. Agric. J., 1916, 5, 104–106. Bull. Agric. Intell., 1916, 7, 687–688.

THE authors have tested a number of barks from Queensland trees, some of which yield useful woods for the timber industry. Barks containing over 20% of tannin are capable of being exploited directly for tanning purposes; to this class belong: an undetermined species of acacia known as "black wattle," *Acacia implexa*, and the inside bark of *Eucalyptus Cloeziana* ("Gympie messmate") which constitutes about one-half the total bark thickness. Barks containing between 10 and 20% of tannin may be useful in certain circumstances and may be exploited for the manufacture of tanning extracts, particularly if derived from large timber trees. The more interesting of this class are: *Acacia harpophylla* ("Brigalow") containing 16%, which is widely distributed in the West and common on the prickly pear-infested lands; *Eucalyptus microcorys* ("Tallow wood"), with 17.66%, is a coastal tree but becoming rather

scarce; *E. haemostoma* ("white" or "scrub gum") contains 11.97%, the wood is largely used for fencing and firewood; *E. Cloeziana* ("Gympie messmate"), which is fairly abundant in the neighbourhood of Gympie, is large and gives a useful hardwood; the entire bark contains 11.95% of tannin.—J. F. B.

Chestnut extract; Trading in — Board of Trade J., Oct. 26, 1916.

THE Army Council have ordered that no person shall buy, sell, deal in, or make delivery of chestnut extract imported from any country other than an Allied country or dependencies thereof after Aug. 1st, 1916, except as authorised and permitted by or on behalf of the Director of Army Contracts.

[Tannery] lime liquors; Determination of sulphide in — H. G. Bennett. Collegium (London), 1916, 219–233. (See also this J., 1916, 479.)

THE author recommends the addition of both ammonia and ammonium chloride to the N/10 zinc sulphate solution used for the titration of the sulphide as suggested by Blockey and Mehd (this J., 1912, 360; 1914, 269). The difficulties attending the use of a solution to which ammonia alone has been added, *i.e.* the precipitation of zinc hydroxide and the incomplete precipitation of zinc sulphide due to the formation of complex ions, are largely avoided, though the method is not suitable for liquors containing less than 0.1% of sodium sulphide. If the reagent is made up according to the author's prescription (Collegium, London, 1915, 314), an amount of liquor needing at least 3.5 c.c. of reagent should be used to ensure solution of zinc hydroxide initially precipitated by the lime. The copper sulphide precipitation method of McCandlish and Wilson (this J., 1911, 606) is criticised on account of the uncertain composition of the sulphide precipitate. As a rapid control method the liquor may be treated with excess of sodium arsenite solution, acidified, the arsenic sulphide and organic matter filtered off, and an aliquot portion of the filtrate titrated with iodine solution after adding excess of sodium bicarbonate.—F. C. T.

Use of bark for paper specialities. Kress. See V.

PATENTS.

Depilation or de-wooling of skins; Process for — R. Vidal. First Addition, dated July 10, 1914. to Fr. Pat. 474,426, Nov. 27, 1913 (this J., 1915, 1105).

A TEPID or cold solution of the preparation of castor oil and alkali sulphide described in the principal patent, acts as a swelling, degreasing, and unhairing agent on skins immersed in it or painted with it on the flesh.—F. C. T.

Waterproofing the soles of footwear [with nitro-cellulose, etc.]. A. V. St. Armande, Nitschill, Scotland. Eng. Pat. 12,840, Sept. 8, 1915.

A MIXTURE of nitrocellulose (which may be in the form of celluloid), nitrated castor or other oil, and a germicide such as β -naphthol, is applied to the leather or other fabric by painting on in solution or by fastening on as a solid layer or sheet. Pigments, dyes, etc., may be added to the material.—F. C. T.

Glue and other adhesives; Substitute for — V. G. Bloede, Catonsville, Md. U.S. Pat. 1,198,100, Sept. 12, 1916. Date of appl., Jan. 2, 1915.

A COMPOSITION is claimed consisting of starch or hydrolysed starch, caustic alkali, and a lead compound.—F. C. T.

Casein masses; Process and apparatus for the manufacture of transparent horn-like—A. Bartels, Harburg, Germany. Eng. Pat. 13,203, Sept. 15, 1915.

DRY commercial casein is agitated with a solvent for fats, notably a mixture of alcohol with petroleum spirit or benzene, at a temperature above that of the atmosphere, and is then dried and treated in the usual manner. The casein may be introduced into a removable strainer drum, which rotates in a horizontal cylinder containing the solvent. After complete extraction of the fat, the solvent is drawn off, and the casein is heated in the same drum *in vacuo*.—C. A. M.

Casein made by the use of rennet. Soc. di Esportazione Polenghi-Lombardo, and E. Soncini. Fr. Pat. 478,290, Mar. 9, 1915. Under Int. Conv., Mar. 25, 1914.

LACTIC ferment is added to milk, which, after a certain acidity has been attained, is coagulated at 40° C. by means of rennet. Casein so produced is soluble in acids and alkalis, and when in alkaline solution is not precipitated by calcium or barium hydroxide. It is also superior in binding power to ordinary casein.—F. C. T.

XVI.—SOILS; FERTILISERS.

α-Crotonic acid, a soil constituent. E. H. Walters and L. E. Wise. J. Agric. Res., 1916, 6, 1043—1045.

A SAMPLE of infertile Susquehanna fine sandy loam soil from Texas was extracted with a 2% solution of sodium hydroxide for 24 hours. After acidifying and filtering, the liquid was extracted with ether, and the concentrated ethereal solution shaken with sodium bisulphite to remove aldehydes, etc. The bisulphite solution was then extracted repeatedly with ether, the combined extracts were evaporated, and the residue sublimed. The purified sublimate was identified as pure α-crotonic acid. The yield obtained was 94 mgrms. from 50 lb. of soil. It is suggested that the acid may be a decomposition product of cellulose, or it may result from the hydrolysis of allyl cyanide, a constituent of the essential oils from certain plants.—E. H. T.

Phosphoric acid; Effect of — on the decomposition of sugar in the soil. S. Herke. Kiserletrigyi Közlemények, 1915, 18, 857—884. Bull. Agric. Intell., 1916, 7, 645—646.

THE decomposition of sugar in soil, as measured by the amount of carbon dioxide liberated, is conditioned by the chemical nature of the soil and by the presence of certain nutritive salts. There appears to be a connection between such action on the part of phosphoric acid and the larger yields which it produces in manurial experiments. Experiments on oats and mustard demonstrated that increased crop yields and increased liberation of carbon dioxide advanced *pari passu*. The accelerating action of phosphoric acid on the decomposition of soil sugar is favourably influenced by calcium carbonate, by nitric nitrogen (0.05 grm. per kilo. of soil, applied as sodium nitrate), by ammonium sulphate (0.05 grm. nitrogen per kilo.) in certain soils, and by potassium sulphate in some cases. In general, the addition of nitrogenous and potassium compounds affects the action of the phosphoric acid in different ways in different soils, and a variation in the amount of one nutritive salt influences the action of the other.—E. H. T.

Bacterised peat ("humogen"); Experiments with — F. J. Chittenden. J. Roy. Hortic. Soc., 1915, 41, 305—326. Bull. Agric. Intell., 1916, 7, 651—655.

POT experiments with begonia plants (*Begonia semperflorens*) and with *Eupatorium adenophorum* grown in loam, in loam and raw peat, and in loam with bacterised peat, showed the fertilising power of the last named in an unmistakable manner. Similar tests on seedling tomatoes gave a like result; it was however remarked that the increased development was confined to the aerial parts of the plants. The difference between the loam series and the loam and raw peat series was very slight, and that between the bacterised and the raw peat was too great to be ascribed to difference in water-retaining capacity. The hypothesis that the treated peat contains "activators" is supported by the fact that large doses of it caused very little increase in growth but were not detrimental. Tomatoes were also grown in sand cultures and watered with extracts of bacterised peat, boiled peat, untreated peat, and with an ammoniacal extract of raw peat. None of the plants did well; those treated with the ammoniacal extract died within two days, and those that received the humogen grew to twice the size of the rest. Hence it is inferred that the particular virtue of this fertiliser lies in its water-soluble constituents. The results obtained in the field experiments were much less satisfactory. Radishes, turnips, and French beans were grown in a very sandy soil, and dressings of 2 tons per acre were used for both treated and untreated peat. There was no difference in the growth of the plants in either, or in the control plot. "Early White Stone" turnips were cultivated in plots receiving (a) no dressing, (b) humogen (1 ton per acre), and (c) the same plus 150 grms. of manganese sulphate. There was a slightly accelerated growth and a small increased yield in (b), but the increase was mostly in the leaves. In (c) the root and aerial development was balanced. The yield of dwarf French beans was 12% greater in soil dressed with humogen, and 3% greater in the same soil manured with untreated peat, than in the control plot. No visible effect attended the application of bacterised peat, at the rate of 3 tons per acre, on a grass plot measuring 10×60 ft. The effects of (1) humogen on turnips growing in a poor, unmanured soil was compared with those obtained by using (2) humogen and farmyard manure, (3) farmyard manure, (4) the same together with artificials, (5) no manure, (6) lime, (7) humogen and lime. Seven of the ten plots were watered artificially. The order of response for the roots only was: 7 (best), 5, 3, 2 and 4, 6, 1, and for the whole plants: 4, 7, 3, 2, 1, 6, 5. The watered plots as a whole did better than the unwatered, but in the latter the bacterised peat diminished the yield. Similar experiments performed in 1915 on radishes, grown under glass and in the open, and upon turnips, showed that as regards the weight of the roots, the effect of the fertiliser was negligible; it probably varies in composition. Twenty tons of farmyard manure costing £8 (delivered) is better value than 1 ton of bacterised peat at £10.—E. H. T.

Ammonia [in soil extracts]; Aeration method for [determination of] — B. S. Davison, E. R. Allen, and B. M. Stubblefield. J. Ind. Eng. Chem., 1916, 8, 896—899.

EXPERIMENTS with ammonium sulphate solution, and with soil extracts, with and without addition of ammonium sulphate, showed that quantities of ammonia up to 24 mgrms. can be recovered quantitatively from 250 c.c. of solution by adding 0.5 grm. of magnesia and drawing air through at

the rate of 1080 litres per hour for 2½ hours. The ammonia cannot be absorbed completely from the air unless the latter is scrubbed well, for instance in a tower containing pieces of glass rod, as it passes through the absorbing acid.—A. S.

Utilisation of the residues of oil extraction from olives. Chevalier. See XII.

Exchange of bases by silicates. Exchange of alkalis and ammonium by hydrous aluminium-alkali silicates (permutites). Ramann and others. See XIX.

PATENTS.

Bones; Process for pulverising — for manure. C. Deguide. Fr. Pat. 478,792, May 25, 1915.

BONES either fresh or degelatinised are dried at a temperature not so high as to decompose organic matter, and subsequently reduced to very fine powder. A temperature of about 100°C. is suitable.—F. C. T.

Antimony compounds for the treatment of parasites and parasitic diseases of plants. Fr. Pat. 479,097. See XIX.

XVII.—SUGARS; STARCHES; GUMS.

Sucrose; Constants of the quartz-wedge saccharimeter, and the specific rotation of —. Part I. Constants for the 26-grm. normal weight. F. Bates and R. F. Jackson. U.S. Bureau of Standards. J. Wash. Acad. Sci., 1916, 6, 25—31.

THE sucrose used was carefully purified, and dried by heating *in vacuo* at 50°—60°C. The absolute rotation of the sucrose solutions was measured with a large polarimeter having a silver scale reading to thousandths of a degree; the light source was the yellow-green line $\lambda = 5461$ Å. from a quartz mercury-vapour lamp. In the saccharimetric tests, two different makes of instrument were used in each experiment, viz., a Bates saccharimeter, type Eric, and either a Schmidt and Haensch or a Julius Peters instrument, the mean value of the readings of the two instruments being taken as the true result. According to the mean value of the results of ten experiments, the solution of the normal weight of sucrose gave a rotation of but 99.89, "sugar degrees" when the saccharimeter was calibrated by means of the Herzfeld-Schönrock conversion factor, 34.657 (see this J., 1904, 561). Taking the actual reading of the normal sugar solution as 100°, the sugar values of the quartz plates used for calibrating the saccharimeters were re-calculated, and it was found that the true conversion factors are 34.620° for $\lambda = 5892.5$ and 40.690 for $\lambda = 5461$. For the normal sucrose solution the absolute rotations are 34.617° for $\lambda = 5892.5$ and 40.763° for $\lambda = 5461$. The rotary dispersion curves of the quartz plate and of the sucrose solution cross at about $\lambda = 0.585\mu$; the slight difference in the rotary dispersions causes differences in the saccharimetric readings when various light sources are used. It is computed that the thickness of the normal quartz plate is 1.5934—1.5940 mm. The values for the specific rotation of sucrose from the authors' data are $[\alpha]_{589.2}^{20} = 66.529^\circ$ and $[\alpha]_{546.1}^{20} = 78.342^\circ$.—A. S.

Dextrose; The saccharimetric normal weight and the specific rotation of —. R. F. Jackson. U.S. Bureau of Standards. J. Wash. Acad. Sci., 1916, 6, 530—531.

THE dextrose employed was prepared by repeated crystallisation from starch conversion products

or invert sugar, and was finally dried at 60°—80°C. in a vacuum. The density of its aqueous solutions was found to correspond to the formula $D_4^{20} = 0.9984 + 0.003788p + 0.00001412p^2$, where p is the percentage of anhydrous dextrose weighed in a vacuum. The formula is valid for values of p between 5 and 30. The normal weight of dextrose weighed in air with brass weights is 32.231 grms. This contained in 100 c.c. of solution produces a rotation of 100° on the scale of the quartz-wedge saccharimeter when the latter is controlled by the conversion factor determined by Bates and Jackson (see preceding abstract), viz. 34.620° for $\lambda = 5892.5$ or 40.690° for $\lambda = 5461$, or by the rotation of 26.0 grms. of sucrose in 100 c.c. of solution. Calibrated by the erroneous Herzfeld-Schönrock factor, 34.657°, the normal weight of dextrose is 32.264 grms. For solutions more dilute than normal, the rotations deviate from proportionality, and a small correction must be applied. The specific rotation, which is a function of the concentration of dextrose, is given by the formula $[\alpha]_{589.2}^{20} = 62.032 + 0.04257c$ where c is grams of anhydrous dextrose weighed *in vacuo* and contained in 100 c.c. of solution, or to the formula $[\alpha]_{546.1}^{20} = 62.032 + 0.0422p + 0.0001897p^2$, where p is the percentage of dextrose by weight *in vacuo*.—G. F. M.

Potato starch factories in Hungary; Waste waters from —, their noxious action and purification. J. Halmi. Vizügyi Közlemények, 1916, 6, 1—22. Bull. Agric. Intell., 1916, 7, 736—738.

THE volume of waste waters from the starch factories amounts to 1.4—2.8 cub. ft. per cwt. of potatoes, according to the methods of manufacture; the working of the factories covers only 3 or 4 months in the winter, during which over 2½ million cwt. of potatoes is worked up. A quantity of from 459,121 to 918,242 cub. ft. of waste water is thus discharged daily during the period of activity. Under these conditions the method of purification by irrigation was found too cumbersome, and has been abandoned in favour of a mechanical system. Good results have been obtained by a system based on the following principles: purification of the potato-washing waters by decantation; accumulation in special ditches of the noxious waste water obtained in the various manufacturing operations, and their emptying after fermentation. The innocuous water derived from the potato-washing, amounting to about one-third of the total, is run into a tank capable of holding the deposited solid matters collected during the whole season's working as well as the water passing through at a speed of 5 mm. per sec. The deposit generally amounts to 5% of the potatoes worked, i.e. about 25 cub. ft. per 10 ton wagon of potatoes. The tank is divided into sections for separate repairs and the outlet is protected by a wire sieve and boards to deflect floating matter. The noxious waters from the starch manufacture, amounting to two-thirds of the whole, are run over dyked areas of ground, with no outlet, to a depth of about 3 ft., and there left to ferment. The area required for small factories is about 5 acres and for large factories (20 wagons per day) 85 acres. Part of the water disappears by percolation and evaporation; the remainder requires about 4 months for fermentation before it is fit for release under the control of the authorities. The soil thus manured is suitable for cultivation.—J. F. B.

PATENTS.

Starch or its derivatives; Manufacture of —. Anon. Borrás. Fr. Pat. 478,185, Mar. 27, 1915. See Eng. Pat. 100,675 of 1916; this J., 1916, 860.

Clarifying agents from the nitro-derivatives of resins balsams, or their constituents. Ger. Pat. 292,542. See XIII.

Substitute for glue and other adhesives. U.S. Pat. 1,198,100. See XV.

XVIII.—FERMENTATION INDUSTRIES.

Pentose or pentosans [in brewing materials]: Determination of — by means of Fehling's solution. J. L. Baker and H. F. E. Hulton. Analyst, 1916, 41, 294—297.

EYNON and Lane's modification of Flohil's method (see this J., 1912, 259) was applied to the determination of pentoses and pentosans in malt, barley, wort, beer, etc. The material was distilled in the usual way with hydrochloric acid (sp. gr. 1.06) until all the furfural had passed over into the distillate; working with 2 grms. of material, or 30 c.c. of liquid samples, it was usually found that the whole of the furfural had distilled when about 300 c.c. of distillate had been collected, but the distillation was always continued until a drop of the distillate no longer gave a reaction with aniline acetate. The acidity of the distillate was determined by titrating 10 c.c. with $N/2$ sodium hydroxide solution and from this titration was calculated the amount of sodium chloride which would be present in an aliquot portion of the neutralised distillate (see below). An aliquot portion, say 50 to 70 c.c., of the distillate was then neutralised with concentrated sodium hydroxide solution, diluted to 80 c.c., mixed with 20 c.c. of Fehling's solution, and heated to boiling under a reflux condenser; the boiling was continued for exactly 35 mins., the cuprous oxide then collected and weighed, after oxidation, as cupric oxide. During the boiling, a piece of asbestos board was placed between the burner and the flask to prevent overheating of the sides of the flask. Three mgrms. of cupric oxide represents approximately 1 mgrm. of furfural; the ratio furfural/copper varied from 0.3 to 0.32 (see Eynon and Lane, *loc. cit.*). The correction for the amount of cuprous oxide precipitated from Fehling's solution by sodium chloride was somewhat larger than mentioned by Eynon and Lane, especially with the larger quantities of sodium chloride, but it was found that the amount of cuprous oxide thus produced decreased considerably if, instead of boiling the mixture, the flask was immersed in a boiling water-bath. This alteration in the method is recommended since the furfural-copper value *per se* is not affected. The quantities of cupric oxide yielded by varying amounts of sodium chloride were as follows:—

| Grms. sodium chloride. | Mgrms. CuO. | | |
|------------------------|-----------------|-------------------|----------------------------|
| | Eynon and Lane. | Baker and Hulton. | Boiling water-bath method. |
| 0 | 6 | 9 | 2 |
| 7 | 11.3 | 12.5 | 3 |
| 10 | 13.0 | 20.0 | 4 |

It is probable that the production of large quantities of cuprous oxide when sodium chloride and Fehling's solution are boiled over a flame is due to the raising of the boiling point of the mixture. The authors also recommend the use of larger quantities of Fehling's solution and distillate, so that the weight of cupric oxide obtained is increased whilst the error is decreased. —W. P. S.

XIXA.—FOODS.

Milk; Resistance of non-sporing bacteria in — to the action of heat. C. Gorini. Rend. Reale Inst. Lomb., 1915, 48, 956—961. Bull. Agric. Intell., 1916, 7, 740.

ALTHOUGH, as a general rule, the sporing bacteria are most resistant to heat, it has been found that milk which has turned sour after sterilisation at 100° C. contains non-sporing types. Investigation has shown that the protection afforded to these forms of bacteria is due to the formation of a covering of casein around the cells, owing probably to the biochemical or acid-producing action of the bacteria themselves. Experiments performed on cultures of these bacteria proved that it was not possible to reproduce the protective phenomena under artificial conditions.—J. F. B.

Citric acid in milk; Determination of —. K. Rudolf. Arch. Chem. u. Micros., 1915, 8, 129—133. Bull. Agric. Intell., 1916, 7, 739. (See also this J., 1915, 974.)

STAHR's method for the determination of citric acid in wine may readily be applied to milk. 50 c.c. of milk is treated with 10 c.c. of sulphuric acid diluted with an equal volume of water; 2 c.c. of a 40% solution of potassium bromide is added and 20 c.c. of phosphotungstic acid solution; the mixture is made up to 200 c.c., shaken, and filtered. 150 c.c. of the filtrate is treated in an Erlenmeyer flask with 25 c.c. of freshly prepared saturated solution of hydrobromic acid, heated on a water-bath at 48°—50° C. for 5 mins., and 10 c.c. of 50% solution of potassium permanganate is gradually added with constant agitation. The remaining operations are the same as in the case of wine (*loc. cit.*). The amount of citric acid per 100 c.c. of milk is found by multiplying the weight of the pentabromoacetone by 1.215. Milk obtained direct from a healthy cow contained 0.1985 grm. of citric acid per 100 c.c. The milk contains more citric acid at the beginning of the milking than at the end. When ordinary milk is allowed to stand, the proportion of citric acid diminishes as curdling advances; completely sour milk contains none. Yoghurt is fairly rich in citric acid (0.1668 grm. per 100 c.c.), which does not decrease appreciably on standing.—J. F. B.

Fat content of dried whole milk; Determination of the —. K. Mohs. Z. ges. Getreidew., 1916, 8, 37—41. Z. angew. Chem., 1916, 29, Ref., 411.

SAMPLES of dried whole milk which have been kept for some time show an apparent reduction of fat content as determined by extraction with ether. This appears to be due to adsorption of the fat by the coagulated protein of the milk. The adsorbed fat is not removed by simple extraction with ether. The following procedure, based on a method described by Neumann (Z. ges. Getreidew., 1912, 4, 8), is recommended for the determination of the fat:—1.5 grms. of the finely divided milk powder is heated with 50 c.c. of water and 6 c.c. of hydrochloric acid of sp. gr. 1.125 for 1½ hours on a boiling water bath. After cooling, the solution is made neutral to methyl orange by addition of concentrated sodium hydroxide solution, then acidified with dilute hydrochloric acid, and filtered. The filter with its contents is dried for 2 hours at 105° C. and then extracted with ether for 6 hours in a Soxhlet apparatus.—A. S.

Rice; Milling of — and its mechanical and chemical effect upon the grain. F. B. Wise and A. W. Broomwell. U.S. Dept. Agric., Bull. No. 330, 1—29. Bull. Agric. Intell., 1916, 7, 588—589.

GREAT breakage is caused by the "plantation huller" especially to rice of the Honduras type.

For example, after the first hulling only 32.0% of whole grains was left, and after the second hulling 9.6%. The effect of modern milling machinery is shown by the following results indicating the percentage of whole grains in the products obtained in the successive stages of milling:—

| | Paddy machine. | Hullers and pearling cone. | Brush (polishing without tale). | | Trombles (for coating in the glucose state). |
|-------------------|----------------|----------------------------|---------------------------------|-------|--|
| | | | In. | Out. | |
| Honduras rice ... | 74.35 | 52.51 | 49.96 | 52.57 | 51.69 |
| Japan rice | 92.38 | 84.22 | 80.37 | 82.32 | 82.57 |

The product from the "plantation huller" yields less ash, ether extract, and crude fibre than the rice from the old mortar and pestle mills. The effect of modern milling machinery is shown in the following results:—

| Milling stage. | Moisture. | Ash. | Ether extract. | Crude fibre. | Proteins. | Pentosans. |
|--------------------------------|-----------|-------|----------------|--------------|-----------|------------|
| Honduras rice | 11.27 | 5.40 | 1.58 | 8.67 | 7.48 | 5.90 |
| Rough rice | 12.32 | 1.18 | 1.79 | 0.99 | 8.57 | 2.42 |
| Rice from paddy machine | 12.56 | 0.53 | 0.40 | 0.39 | 7.79 | 1.90 |
| Do. hullers .. | 12.50 | 0.47 | 0.28 | 0.30 | 7.88 | 1.53 |
| Do. pearling cone .. | 11.89 | 0.30 | 0.25 | 0.30 | 8.06 | 1.80 |
| Do. brush .. | 12.02 | 0.40 | 0.21 | 0.26 | 7.75 | 1.66 |
| Do. trumble | — | 60.00 | 85.00 | 73.00 | 10.00 | 32.00 |
| Total loss in dry substance .. | | | | | | |

Very similar results were obtained with Japan rice. Milled rice is graded according to the percentage of whole grains and size of the particles. Thus Honduras rice is sold as:—(1) *Fancy head or head*, containing about 80% of whole grain and yielding about 59 lb. per barrel of rough rice; (2) *Second head*, consisting of broken grains, yielding 19 lb. per barrel; (3) *Screenings*, yielding 15 lb., and (4) *Brewers' rice*, yielding 8 lb. per barrel. Japan rice is sold in 3 grades:—(1) *Fancy head or head*, containing 90% of whole grains, and yielding 96 lb. per barrel of rough rice; (2) *Screenings*, and (3) *Brewers' rice*, each yielding 5 lb. per barrel. The hulls approximate 30 lb., rice bran 20 lb., and the rice polishings 6 lb. per barrel of rough rice. The higher commercial grades of rice contain slightly less ash, ether extract, and crude fibre than the lower or more broken grades. Rice hulls are rich in ash, crude fibre, and pentosans, but contain little fat or protein, whilst the bran and polishings are rich in fat and protein and, when fresh, are regarded as good feeding stuffs.—C. A. M.

Benzoic acid; Detection of — in [edible] fats. W. Stadlin. Chem.-Zeit., 1916, 40, 770.

FROM 20 to 30 grms. of the semi-melted fat is spread in an even layer over the parchment diaphragm of a Kreis dialyser, and covered with 50% alcohol. The outer chamber of the dialyser is charged with alcohol of the same strength, and after 24 hours the dialysate is rendered slightly alkaline and evaporated on the water bath to expel the alcohol, the volume of the liquid being maintained by the addition of water. It is then made slightly acid, shaken twice with ether, and the extracts evaporated at a low temperature. The residue, which crystallises in groups of fine needles, is dissolved in 10 c.c. of water, and tested with 3 drops of dilute (1:10) hydrogen peroxide solution, 3 drops of dilute (1:10) official ferric chloride solution, and 3 drops of 3% ferrous

sulphate solution. The violet coloration due to salicylic acid appears after about $\frac{1}{2}$ min. If salicylic acid is also suspected the same method is used, with the exception that the ferric chloride reaction is applied prior to the oxidation with hydrogen peroxide.—C. A. M.

Nitrogenous constituents of fodders; Determination of —. N. Passerini. Annali Chim. Appl., 1916, 6, 162—164.

THE following method is recommended for rapidly obtaining information as to the nature of the nitrogenous constituents of fodders. It is based on the fact that proteins are converted almost completely into soluble substances by hydrolysis with boiling 25% sulphuric acid for 4 hours. The amides are separated from a 2-grm. sample by Kellner's method, and the crude protein (b) is determined in the copper precipitate. From another 5-grm. sample, the amides are separated as before, and the copper precipitate is boiled with 100 c.c. of 25% sulphuric acid under a reflux condenser for 4 hours. The resulting solution is treated with hydrogen sulphide to precipitate copper, diluted to 500 c.c., filtered through a dry paper, and in 200 c.c. of the filtrate the ammoniacal nitrogen (c) is determined by distilling with a slight excess of sodium hydroxide, after expelling hydrogen sulphide. In the residue from the acid hydrolysis, the non-hydrolysed (nuclein) nitrogen (d) is determined. If the total nitrogen is represented by a, then the nitrogen present as amides (asparagine, etc.) is a-b, and the amino-acid nitrogen is b-(c+d).—A. S.

Determination of pentose or pentosans by means of Fehling's solution. Baker and Hulton. See XVIII.

Nitrogen determinations by direct nesslerisation. Folin and Denis. See XXIII.

PATENTS.

Flour bleaching apparatus. F. Stacey, Birmingham. Eng. Pat. 17,841, Dec. 21, 1915.

IN apparatus for treating flour with nitrogen peroxide or other gas, the admission orifice for the gas consists of a hole in a disc or plate fitted in the vertical inlet pipe; the under side of the hole is countersunk so that the plate immediately round the hole is extremely thin. The plate is readily removed when the hole becomes choked; a trap tube is provided in a small chamber above the plate for the purpose of removing some of the suspended particles from the gas.—W. P. S.

Yolk of egg or gluten; Substitute for — and process for making the same. Moskovits Mór és Fia, Nagyvárad, Hungary. Eng. Pat. 160,135. Mar. 2, 1916. (Appl. No. 3149 of 1916.) Under Int. Conv., Mar. 2, 1915.

Yolk of egg substitute. Five grms. of sunflower oil is emulsified with 11 grms. of blood serum previously evaporated to the consistence of a syrup. *Gluten substitute.* Five grms. of enoconut oil or linseed oil is emulsified with 500 grms. of concentrated blood serum; this emulsion mixed with 1 kilo. of potato flour and baked, forms a bread substitute.—W. P. S.

Eggs; Method of preserving —. A. N. Bennett, Assignor to Sterilized Egg Co., Chicago. U.S. Pat. 1,197,707, Sept. 12, 1916. Date of appl. Feb. 11, 1916.

Eggs are subjected to the action of hot dry air for a length of time sufficient to evaporate the moisture on and in the shell and to coagulate the

membranous and albuminous layers of the eggs immediately next the inner side of the shell; the eggs are then treated with a hot solution which forms a coating on the outside of the shell.

—W. P. S.

Rice food. T. J. Sugimoto, San Francisco. U.S. Pat. 1,198,304, Sept. 12, 1916. Date of appl. Sept. 29, 1915; renewed, Aug. 14, 1916.

GLUTINOUS rice is steamed, mixed with about 25% of its weight of sugar, flavouring material is added, and the mixture is formed into a thin flat cake which is cut into strips and dried.—W. P. S.

Beverage extracts; Manufacture of—J. L. Kellogg, Assignor to Kellogg Toasted Corn Flake Co., Battle Creek, Mich. U.S. Pat. 1,198,393, Sept. 12, 1916. Date of appl. Apr. 24, 1916.

STARCH-BEARING material (grain) is cooked for 40 mins. to dextrinise the starch, then dried, roasted, mixed with caramelised saccharine material, and the mixture percolated.—W. P. S.

Clarifying agents from the nitro-derivatives of resins, balsams, or their constituents. Ger. Pat. 292,542. See XIII.

XIXB.—WATER PURIFICATION; SANITATION.

Sea water; Effect of the addition of alkali to—on the hydrogen ion concentration. A. R. Haas. J. Biol. Chem., 1916, 26, 515—517.

ON the addition of alkali solution to sea water the hydroxyl ion concentration rises rapidly at first and then very slowly until the magnesium hydroxide has been precipitated. Another fairly rapid rise then takes place, as the addition is continued, but is checked by the precipitation of calcium hydroxide. Subsequently, the addition of alkali causes a corresponding increase in the hydroxyl ion concentration.—W. P. S.

Exchange of bases by silicates. Exchange of alkalis and ammonium by hydrous aluminium-alkali silicates (permutites). E. Ramann, S. März, K. Biesenberger, and A. Spengel. Z. anorg. Chem., 1916, 95, 115—128. Z. angew. Chem., 1916, 29, Ref., 398.

THE replacement of the bases of permutites by alkalis and by ammonium depends upon ionic reactions; equivalent quantities of the cations are introduced into the permutite, independent of the nature of the anion present in the solution. The composition of the permutite at the end of the reaction is independent of the total concentration of the solution. Similar relations hold in the case of the silicates, analogous to permutites, present in the soil.—A. S.

Utilisation of the residues of oil extraction from olives. Chevalier. See XII.

Waste waters from potato-starch factories in Hungary: their noxious action and purification. Halmi. See XVII.

PATENTS.

Water used for steam generators and for other purposes; Electrically indicating the presence of saline, alkaline, or acid impurities in feed—W. C. Crockett, and Bromell Patents Co., Ltd., Glasgow. Eng. Pat. 101,387, Apr. 8, 1916. (Appl. No. 5163 of 1916.)

THE water is passed through a vessel containing two carbon electrodes which are connected with a

source of electrical energy of approximately constant voltage; a suitable electric lamp is also placed in the circuit. So long as the water remains pure, the resistance is high and the lamp does not glow, but if any saline impurity enters the water the resistance is lowered and the lamp filament commences to glow, its brilliancy increasing with the proportion of the impurity. A voltmeter may also be placed in the circuit to indicate changes in the resistance of the water and thus afford an additional means of ascertaining the presence of impurities in the water.—W. P. S.

Sterilisation of drinking water and other liquids; Mechanical—without the use of chemicals. L. Linden. Fr. Pat. 478,797, May 25, 1915. Under Int. Conv., May 26, 1914.

THE water to be sterilised is violently and rapidly agitated by any convenient means, preferably in a closed receptacle or series of receptacles, so that every particle of the water undergoes agitation. Sterilisation is complete in a few minutes. The water may be saturated with air before being agitated.—J. H. J.

Base-exchanging substances [for water-purification]; Preparation of—Water Softeners (France), Ltd. Fr. Pat. 479,152, Sept. 26, 1914. Under Int. Conv., Nov. 13, 1913.

AS an example of the method of preparation, 7.5 kilos. of sodium aluminate is dissolved in 90 litres of water, and the solution is poured into 1067 litres of water. After mixing, 25.185 kilos. of sodium silicate of 40° B., containing about 25% of silica, is added. The solution is stirred for $\frac{1}{2}$ hr., and then intermittently for 3 hrs.; the gelatinous precipitate is separated in a filter-press, washed, and dried at 43° C. It is then washed with hot water, whereby it is converted into hard, vitreous grains. In this form, the substance has very active base-exchanging properties.—J. H. J.

Sewage; Purification of—by the utilisation of activated sludge. E. Long, Manchester. Eng. Pat. 14,733, Oct. 19, 1915.

SCREENED sewage is passed downwards through a pipe containing a form of injector nozzle, and means are provided for admitting air to this part of the pipe (the action is similar to that of an ordinary water pump), or compressed air may be introduced. The mixture of sewage and air passes into a widened portion of the pipe which contains a rotary agitator, and thence through a rotary pump into the bottom of a tank. A pipe connects the top of the tank with the pipe above the injector nozzle, and the apparatus may be worked so as to circulate the contents of the tank until a sludge is obtained so altered in character as to justify the term "activated sludge" (see Ardern and Lockett, this J., 1914, 523, 1122; 1915, 937). The apparatus may also be employed for circulating a mixture of activated sludge and sewage or waste water.—W. P. S.

Sewage; Apparatus for the purification of—G. Pourjoulat. Fr. Pat. 478,669, May 11, 1915. Under Int. Conv., June 22, 1914.

IN a process for the biological purification of sewage, the latter is delivered on to a moving filter composed of agglomerated slag or porous brick. This is made in the form of a hollow cylinder rotating on a horizontal axis, a solid cylinder rotating on a vertical axis, or a cube having a sliding motion. In each case the filter moves under a perforated pipe conveying the sewage.—J. H. J.

Parasites and parasitic diseases of plants; Antimony compounds for the treatment of— [and extraction of antimony from metallurgical products]. C. Vecelli. Fr. Pat. 479,097, June 24, 1915. Under Int. Conv., July 8, 1914.

THE compound is prepared by grinding an antimony ore with quicklime. The lime may be slaked before use, but preferably is slaked at the conclusion of the grinding process. After standing, the mass is ground again. For agricultural use it is diluted with water. The compound may also be utilised in the extraction of antimony from metallurgical products.—J. H. J.

Disinfection of rooms with formaldehyde or by means of Salforkose [a preparation containing formaldehyde and carbon bisulphide]; Removal of noxious vapours after— A. Scholtz, Hamburg. Ger. Pat. 293,559, Feb. 25, 1915.

A MIXTURE of ammonia and menthone or an essential oil containing menthone, especially dementholised Japanese peppermint oil, is vaporised within the room which has been disinfected. The room becomes fit for use more quickly than when ammonia alone is used.—A. S.

Incinerators or refuse destructors. A. Wallis, Shirehampton, Gloucester. Eng. Pat. 14,795, Oct. 19, 1915.

Phenolic condensation products capable of destroying parasites, bacteria, minute growths, etc.; Manufacture of— A. Heinemann. Fr. Pat. 478,635, May 7, 1915. Under Int. Conv., May 8, 1914.

SEE Eng. Pat. 11,394 of 1914; this J., 1915, 815.

Clarifying agents from the nitro-derivatives of resins, balsams, or their constituents. Ger. Pat. 292,542. See XIII.

XX.—ORGANIC PRODUCTS; MEDICINAL SUBSTANCES; ESSENTIAL OILS.

Glycerin as medicine. Board of Trade J., Nov. 2, 1916.

THE following notice has been issued by the Minister of Munitions: As from 1st April, 1916, glycerin manufacturers were asked to obtain from buyers a guarantee that all medicinal glycerin delivered would be used only for making up British Pharmacopœia or B.P. Codex preparations, or where it was prescribed in individual cases, either alone or in combination with other drugs, by a duly qualified medical practitioner. These restrictions were not applied to stocks held by wholesalers or retailers before 1st April, but in view of the increased necessity for conserving the supply for the needs of the War, and the possibility that it may be necessary to reduce still further the quantity to be allowed for medicinal purposes, holders of such stocks are now asked to apply the restrictions to them. Such action will directly serve national interests in tending to secure a sufficient supply of glycerin for the general public in those cases where its value for medicinal purposes is of importance.

Vitamines; Chemical nature of the— II. *Isomerism in natural antineuritic substances.* R. R. Williams and A. Seidell. J. Biol. Chem., 1916, 28, 431—451. (See this J., 1916, 942.)

THE physiological properties of the vitamins of autolysed yeast were not altered appreciably when the solution was treated with 10% of its weight of sodium hydroxide, allowed to stand for 5 hours,

and then neutralised with hydrochloric acid, but fullers' earth, "activated" by shaking it with autolysed yeast, was affected to a certain extent when subjected to similar treatment with alkali; it lost its power of maintaining the weight of pigeons fed on a deficient diet, but still had the power of preventing the development of polyneuritic symptoms in the birds. By extracting "activated" fullers' earth with 5% sodium hydroxide solution (in dilute alcohol), a crystalline antineuritic substance was obtained, the physiological properties of which were not due to adhering mother-liquor. These crystals lost their curative properties when re-crystallised, and the resulting product proved to be identical with adenine. The latter, when subjected to suitable treatment, e.g., heating with sodium ethoxide, acquired antineuritic properties and gave a blue coloration with the Folin-Macallum reagent (see this J., 1913, 159). It appears that an isomer of adenine is the chemical entity responsible for the characteristic physiological properties of the "vitamine" investigated.—W. P. S.

Aromatic sulphuric acid, U.S.P.; Hydrolysis of ethylsulphuric acid and assay of— W. B. D. Penniman, W. W. Randall, C. O. Miller, and L. H. Enslow. J. Ind. Eng. Chem., 1916, 8, 904—909.

TO effect complete hydrolysis of ethylsulphuric acid by heating with water, the alcohol as formed must be removed; in the case of aromatic sulphuric acid no appreciable hydrolysis of the ethylsulphuric acid takes place until the whole of the free alcohol has been expelled. Methods of analysis, such as that of the U.S. Pharmacopœia, in which the sample is diluted with water and heated under a reflux condenser, always give low results, and lower the more efficient the condenser. Complete hydrolysis can be effected in most cases by diluting the sample of aromatic sulphuric acid with six times its volume of water and heating in an open beaker on a vigorously boiling water bath for 4 hours.—A. S.

Chlorination process; A modified— [Preparation of ethylene dichloride and chloro-derivatives of benzene.] J. A. Snythe. Brit. Assoc., Newcastle, 1916. Sect. B.

COMBINATION between ethylene and chlorine is brought about very readily in presence of calcium chloride. When the ethylene is kept in slight excess, the main product of the reaction is ethylene dichloride, but some trichloroethane is also formed; the two compounds are easily separated by fractional distillation. The author has devised a modification of Newth's method of preparing ethylene (this J., 1901, 757), in which difficulties connected with the feed of alcohol and arising from the action of phosphoric acid on glass have been overcome.

The use of calcium chloride in chlorination-reactions has also been studied in the case of benzene. Here, too, substitution and addition take place and the products of reaction contain mono and di-chlorobenzene and also the two isomeric forms of benzene hexachloride. The yield of the latter is considerable.

Some points of theoretical interest were dealt with, especially the similarity in the action of calcium chloride and sunlight in these chlorination processes.—J. A. S.

Catalytic hydrogenation of organic compounds with base metals at the ordinary temperature. Influence of contact poisons on hydrogenation. C. Kelber. Ber., 1916, 49, 1868—1879.

THE behaviour of a nickel catalyst towards anti-catalysts has been found to differ considerably

according to its method of preparation. The catalyst prepared by reducing basic nickel carbonate with hydrogen at 450° C. was much more sensitive to contact poisons than a catalyst prepared similarly at 310° C., and the catalyst distributed on an inorganic carrier and reduced at 450° C. (this J., 1916, 382) was remarkably resistant to poisoning by antecatalysts, e.g., hydrogen cyanide, hydrogen sulphide, and carbon bisulphide.—F. W. A.

Italian turpentine. Oil of turpentine from *Pinus pinea*, L. Palazzo. See XIII.

Nitrogen determinations by direct nesslerisation. Folin and Denis. See XXIII.

PATENTS.

Acetals; Manufacture of—. A. T. King and F. A. Mason, London. Eng. Pat. 101,428, Jan. 4, (Appl. No. 134 of 1916) and July 13, 1916. (Appl. No. 9873 of 1916.)

ACETALS of the type $\text{CH}_3\text{.CH(OR)}_2$, in which R is an alkyl radicle, are obtained by treating a mixture of acetaldehyde (20—50%) and an aliphatic alcohol with hydrated or dehydrated chlorides or nitrates of aluminium, beryllium, calcium, cerium, lithium, magnesium, manganese, thorium, etc., with or without addition of hydrochloric or other acid. *Example*: 20 c.c. of saturated sodium chloride solution and 10 grms. of sodium chloride are added to 50 c.c. of a mixture containing 40% aldehyde and 60% alcohol, together with 1 c.c. of concentrated hydrochloric acid, and the mixture shaken for some time; the upper layer is washed with water and then sodium carbonate solution, dried over calcium chloride and then potassium carbonate, and finally fractionated to obtain the acetal. —F. W. A.

Catalyzing the synthesis of organic halogen substitution products; Apparatus for—. F. G. Keyes, Boston, Mass., Assignor to Cooper Hewitt Electric Co., Hoboken, N.J. U.S. Pat. 1,198,356, Sept. 12, 1916. Date of appl., July 25, 1913.

AN apparatus is described for promoting the reaction between an organic compound and a halogen, consisting of an enlarged quartz vessel through which passes a mercury vapour lamp with quartz walls. The vessel is provided with a vent tube and condenser, means for supplying and withdrawing the reacting materials, and with stirring gear.—F. Sr.

Chlorine derivatives of organic substances; Preparation of—. Soc. Chim. Usines du Rhône (anc. Gilliard, P. Monnet, et Cartier). Fr. Pat. 479,645, Dec. 24, 1914.

THE substance to be chlorinated is heated with manganese dioxide and hydrochloric acid, or with manganese dioxide, sulphuric acid, and a metallic chloride. For example a mixture of 200 kilos. of benzene, 100 kilos. of manganese dioxide, and 400 kilos. of hydrochloric acid is heated at a temperature a little lower than the boiling point of benzene.—B. V. S.

Nuclein-arsenic compounds and process of preparing same. L. A. Thiele, Upper Sandusky, Ohio. U.S. Pat. 1,197,971, Sept. 12, 1916. Date of appl., June 4, 1914.

NUCLEIN-ARSENIC compounds are prepared by suitable treatment of a mixture of sodium cacodylate with a solution of nucleic acid in an aqueous alkali phenoxide. Particular claim is made to a compound soluble in water and in

alkalis, darkening at 180° C., decomposing at higher temperatures, and possessing valuable therapeutic properties.—F. Sr.

Lecithin; Hydrogenation of—by the catalytic action of common metals and their oxides. Poulenc Frères. Fr. Pat. 478,193, July 22, 1914.

THE hydrogenation of lecithin may be accomplished by the aid of common metals and their oxides, and at a temperature below that at which lecithin and hydrolecithin are decomposed, by having the catalyst in its most active condition, obtained by slow reduction in the case of the metals and by dehydration of the hydroxides at a low temperature in the case of the oxides; by vigorous stirring of the lecithin so as to expose continually fresh surfaces to the action of the hydrogen, and by working under increased pressure.—B. V. S.

Extraction by volatilisation of substances [alkaloids, etc.] liable to decomposition by heat; Process and apparatus for the—. P. Landrin. Fr. Pat. 478,194, July 22, 1914.

THE substance to be extracted is quickly raised to the desired temperature by mixing it with an inert substance at that temperature, local overheating being avoided. The gaseous products are withdrawn and cooled as quickly as they are formed. The apparatus described is an arrangement of concentric cylinders revolving on a horizontal axis, the outermost one heated, the innermost one perforated; the substance to be treated is introduced as a fine powder at one end of the outer cylinder where it is immediately mixed with the hot inert material in granular form; the mixture passes on to the other end of the cylinder, is there picked up by a feed tube and dropped into the cylindrical sieve. The inert material passes back to the starting point while the exhausted material passes through the perforations into an intermediate cylinder and out of the apparatus. By a suitable arrangement of tubes a gaseous current passes through the apparatus in the opposite direction and carries along and cools the gaseous products of the reaction without picking up the powder. The process is suitable for the extraction of caffeine from tea or coffee, and of theobromine from cocoa, etc.—B. V. S.

Esters; Manufacture of—. G. Boiteau. Fr. Pat. 478,435, Aug. 3, 1914.

A MIXTURE of an ester of ethyldene-glycol and an alcohol is heated, preferably in the presence of a small quantity of a catalyst, such as sulphuric acid. Acetaldehyde is evolved and the corresponding ester of the alcohol is contained in the residue. The reaction is general, being obtained with primary, secondary, and tertiary alcohols and with aromatic hydroxy compounds.—B. V. S.

Unsaturated hydrocarbons; Manufacture of—. F. E. Matthews, H. J. W. Bliss, and H. M. Elder, London. U.S. Pats. 1,198,943 and 1,198,944, Sept. 19, 1916. Dates of appl., June 28 and Nov. 25, 1913.

SEE Eng. Pat. 17,234 of 1912; this J., 1913, 884

XXI.—PHOTOGRAPHIC MATERIALS AND PROCESSES.

PATENTS.

Exposure in photography; Process for the reduction of—. L. Paris and G. Picard. First Addition, dated June 30, 1914, to Fr. Pat. 477,173, May 29, 1914 (this J., 1916, 617).

IN making three-colour screens for colour photographs, grains of phosphorescent zinc sulphide are

used instead of starch grains. The grains are saturated with a concentrated solution of alum and then treated with ammonia to produce a thin coating of gelatinous alumina, which can be stained by treatment in a suitable dye solution.—B. V. S.

Photography in colours. Soc. Anon. Franç. Kodak. Fr. Pat. 479,796, Sept. 21, 1915. Under Int. Conv., Sept. 21, 1914.

SEE Eng. Pat. 13,429 of 1915; this J., 1916, 868.

Photographic reproductions; Preparation of—. Soc. Anon. Franç. Kodak. Fr. Pat. 479,797, Sept. 21, 1915. Under Int. Conv., Sept. 21, 1914.

SEE Eng. Pat. 13,430 of 1915; this J., 1916, 907.

XXII.—EXPLOSIVES; MATCHES.

Detonators; The sand test for determining the strength of—. C. G. Storm and W. C. Cope. U.S. Bureau of Mines, 1916. Techn. Paper 125. (68 pages.)

THE test consists in firing the detonator in approximately the centre of a mass of 100 grms. of standard sand contained within the closed cavity of a metal bomb, and measuring (by sifting) the extent to which the sand is pulverised by the detonation. In the present investigation, "Ottawa standard sand," consisting of practically pure quartz and free from particles coarser than 20-mesh or finer than 30-mesh size, was employed in conjunction with electric and ordinary detonators of various sizes charged with mixtures of mercury fulminate and potassium chlorate. For each of the detonating compositions tested, the weight of sand pulverised to a finer degree than 30-mesh was found to be a definite function of the weight of the charge. The relative efficiencies of different fulminate compositions in crushing sand and in causing complete detonation of nitro-substitution compounds of varying degrees of sensitiveness were also found to be comparable; and it is concluded that if these may be taken as a measure of the efficiency of a detonator as used with blasting explosives, the sand test fulfils every requirement of a practical test of the "strength" of commercial detonators.—W. E. F. P.

Committee on dissolved acetylene. See IIA.

Nitration of diethylbenzylamine. Noelting and Kregczy. See IV.

PATENTS.

Nitration process. E. F. Hitch, Alton, Ill., Assignor to Equitable Powder Manufacturing Co., East Alton, Ill. U.S. Pat. 1,198,129, Sept. 12, 1916. Date of appl., Apr. 17, 1915.

NITRO-COMPOUNDS of organic substances, particularly aromatic nitro-hydrocarbons containing two or more nitro groups, are prepared by mixing the liquid hydrocarbon with a sufficient amount of a powdered solid nitrate, and adding sulphuric acid to the mixture.—F. Sp.

Cheap process for the manufacture of chlorine. Fr. Pat. 479,196. See VII.

XXIII.—ANALYSIS.

Sulphuric anhydride; Determination of—. E. G. Pierce. Met. and Chem. Eng., 1916, 15, 353—354.

To induce rapid diffusion and thus inhibit the formation of small crystals of barium sulphate

during precipitation, a boiling solution of barium chloride is added drop by drop to the boiling assay liquid; superheating or bumping is prevented by the use of a "boiling tube"—consisting of a glass capillary attached to a bent stem of convenient length—which is retained in the liquid during the operation so as to produce a stream of fine bubbles on the bottom of the containing vessel. Boiling is continued until the precipitate settles, when the boiling tube is removed and the liquid maintained at just below the boiling point for 2 hours (instead of the 5 hours commonly specified). The liquid is then rapidly cooled and filtered, preferably through "slow" double papers. As the chief loss of barium sulphate is occasioned by the finer particles being washed through the filter, disturbance of the mat of crystals first formed on the paper should be avoided during washing and the quantity of wash-water reduced to a minimum.—W. E. F. P.

Titanium trichloride in volumetric analysis; Use of—. A. Monnier. Ann. Chim. Analyt., 1916, 21, 109—113.

IN estimating ferric chloride (compare Knecht, "New Reduction Methods in Volumetric Analysis," 1910, p. 48, footnote) and chromates (compare Atack, this J., 1915, 1005) by titration with titanium trichloride, the use of methylene blue as indicator is recommended. In the case of cupric salts, which are not reduced until any methylene blue present has been reduced by the titanium trichloride, the use of safranine or induline as indicator is suggested; copper and iron present together in solution may be determined by first titrating an aliquot portion of the solution, using methylene blue as indicator, to find the iron content, and then titrating iron *plus* copper, with safranine or induline as indicator. The necessary correction is made for the titanium trichloride required for the reduction of the indicators, and all titrations are carried out in an atmosphere of carbon dioxide.—F. W. A.

Cobalt (in presence of nickel); Volumetric determination of—. W. D. Engle and R. G. Gustavson. J. Ind. Eng. Chem., 1916, 8, 901—902.

THE method depends on the facts that sodium perborate will completely oxidise cobaltous salts without affecting nickelous salts, and that cobaltic hydroxide liberates iodine from potassium iodide in presence of acid. The solution (100 c.c.) containing cobalt and nickel (e.g., up to 0.25 gm. Co and 0.45 gm. Ni) may contain zinc and alkali and alkaline-earth salts. It is treated with dilute sulphuric acid (about 5 c.c. excess) and then with 1 or 2 grms. of dry sodium perborate. When the perborate has dissolved, the solution is made strongly alkaline with sodium hydroxide, boiled for 10 mins. to decompose the excess of perborate, cooled, treated with 1 gm. of potassium iodide, acidified with dilute sulphuric acid to dissolve the precipitated cobaltic hydroxide, and the liberated iodine titrated with thiosulphate.—A. S.

Selenium; Detection of small quantities of— and its distinction from arsenic. J. Meunier. Comptes rend., 1916, 163, 332—334.

COMPOUNDS of selenium treated in a Marsh's apparatus in the usual way are converted into hydrogen selenide; the latter is decomposed in the heated tube with the formation of a deposit of selenium which in its thickest part shows distinctly the red colour of the element, which cannot be confused with the appearance of the arsenic deposit. With minute quantities of selenium only a slight annular deposit is obtained similar to that of arsenic. On sublimation in an open tube it is

converted into white selenious acid, which is readily distinguished from arsenious oxide by means of solvents. An alternative procedure consists in treating the warmed solution with hydrogen sulphide, when a precipitate is obtained of finely divided sulphur mixed with selenium and arsenious sulphide, if present. The precipitated sulphur is coagulated by warming on the water-bath, when if it contains selenium it assumes a distinct brown colour, whilst the presence of arsenic does not alter the pure yellow colour. After drying the precipitate the sulphur and selenium may be separated by careful sublimation in a closed tube.

—G. F. M.

Nitrogen determinations by direct nesslerisation. O. Folin and W. Denis. *J. Biol. Chem.*, 1916, 28, 473—506.

Total nitrogen in urine. One c.c. of the urine, diluted so as to contain from 0.7 to 1.5 mgrm. of nitrogen per c.c., is heated with 1 c.c. of sulphuric acid containing phosphoric acid and copper sulphate (sulphuric acid, 100 c.c., 85% phosphoric acid solution, 300 c.c., and 10% copper sulphate solution, 15 c.c.) until all water has been expelled. The heating is then continued for about 4 minutes, the clear solution is diluted, neutralised with 10% sodium hydroxide solution, a slight excess of the latter is added, followed by 15 c.c. of Nessler reagent (containing 5% of mercuric potassium iodide and 2% of sodium hydroxide), the mixture is made up to 250 c.c., filtered, and the colour of the filtrate compared with that given by a known amount of ammonium sulphate after this has been treated with the above-mentioned quantities of reagents. *Non-protein nitrogen in blood.* To remove proteins, the blood is diluted with water and treated with 25% metaphosphoric acid solution, allowed to stand for 1 hour, or shaken for 5 mins., and then filtered. The nitrogen in the filtrate is determined as described under urine. The metaphosphoric acid solution used must not be more than 3 days old. *Ammonia in urine.* The ammonia is determined by direct nesslerisation after the urine has been treated with metaphosphoric acid and blood-charcoal; the former removes proteins and the latter more than 90% of the creatinine which may be present. The quantity of creatinine remaining after this treatment does not interfere with the determination. *Urea in urine.* The urea is converted into ammonia by treating the urine with urease (an aqueous emulsion of soya bean meal is used), the mixture then treated with metaphosphoric acid and blood-charcoal, filtered, and the filtrate nesslerised. *Urea in blood.* The "oxalated blood" is treated with urease (soya bean meal), then with metaphosphoric acid, filtered, and the filtrate is nesslerised.—W. P. S.

Filter paper with fine pores. Grossfeld. See V.

Cupellation losses in assaying silver. Mann and Clayton. See X.

Detection of arachidic acid [arachis oil]. Kerr. See XII.

Detection of marine animal oils in oils, fats, and soaps. Marcussan and Von Huber. See XII.

Determination of sulphides in [tannery] lime liquors. Bennett. See XV.

Aeration method for [determination of] ammonia [in soil extracts]. Davison and others. See XVI.

Constants of the quartz-wedge saccharimeter, and the specific rotation of sucrose. Part I. Constants for the 26-grm. normal weight. Bates and Jackson. See XVII.

Saccharimetric normal weight and specific rotation of dextrose. Jackson. See XVII.

Determination of pentose or pentosans by means of Fehling's solution. Baker and Hulton. See XVIII.

Determination of citric acid in milk. Rudolf. See XIXa.

Determination of the fat content of dried whole milk. Mohs. See XIXa.

Detection of benzoic acid in [edible] fats. Stadlin. See XIXa.

Determination of nitrogenous constituents of fodders. Passerini. See XIXa.

Hydrolysis of ethylsulphuric acid and assay of aromatic sulphuric acid, U.S.P. Penniman and others. See XX.

The sand test for determining the strength of detonators. Storm and Cope. See XXII.

PATENTS.

Thermo-electric couple. C. E. Foster, Letchworth. Eng. Pat. 17,185, Dec. 7, 1915.

The elements of a cheap thermo-electric couple, which gives approximately the same electromotive force as a platinum-platiniridium couple, are composed substantially of 94% Ni and 5% Cr, and 85% Ni and 15% Cr, respectively. When commercial nickel is used, the alloys contain small percentages of iron.—T. St.

Electrically indicating the presence of saline, alkaline, or acid impurities in feed water used for steam generators and other purposes. Eng. Pat. 101,387. See XIXb.

Trade Report.

Spanish industries; Government assistance for —. Board of Trade J., Oct. 26, 1916.

A GOVERNMENT Bill, dated Sept. 24th, has been presented to the Spanish Cortes, providing for the granting of certain concessions in favour of establishing new industries, or developing those existing, in Spain. The Bill provides for the granting of concessions to Spanish enterprises engaged in coal production, iron and steel, copper, zinc, and brass industries, fertiliser manufacture, working up Spanish agricultural products, chemical industries (especially dye manufacture), wool washing, manufacture of scientific apparatus, etc. The concessions to be granted are classified as follows:—

(1) *State concessions without direct financial help*, embracing exemption from stamp and other State taxes; postponement of the payment of all other taxes until five years after the commencement of working a new industry; free importation for a period of 15 years of raw materials required for the industry and not produced in the country; fiscal protection for a period of 15 years in respect of manufactures produced by new industries; total exemption from all export duties for 5 years; "temporary admission" regulations to be applied in respect of all raw materials for manufacture in Spain or for working up for export in conjunction with Spanish materials; special banking facilities; special transport tariff rates; exemption from municipal and port dues; preference to the products of Spanish industries in the award of Government contracts.

(2) *Loans authorised directly by the State.*—The amount of such assistance must not exceed 50%.

of the capital necessary for the creation of new industries or the extension of existing ones. The interest to be paid will be 5% annually of the amount received by the industry. The loans will be granted for a maximum period of 10 years, as regards the extension of industries already established, and for 15 years in respect of new industries.

(3) *Guarantee of minimum interest on capital invested.*—With a view to encouraging the establishment in Spain of large industries in respect of which the concessions enumerated above may not be sufficient stimulus, the Government is authorised to guarantee interest not exceeding 5% annually on the capital invested in the undertaking, and for this purpose a sum of up to 10,000,000 pesetas (£400,000 at par) will be included in the annual State estimates. The period during which such interest will be granted will be 15 years.

Prohibited exports. Order in Council, Oct. 23, 1916.

The exportation of basic slag and superphosphates is prohibited to all destinations, and of agar-agar and quillaja bark to all destinations in foreign countries in Europe and on the Mediterranean and Black Seas, other than France and French Possessions, Russia, Italy and Italian Possessions, Spain, and Portugal, and to all ports in any such foreign countries, and to all Russian Baltic ports.

Books Received.

COAL TAR AND AMMONIA. By GEORGE LUNGE, Ph.D. Fifth and enlarged Edition. In three volumes (not sold separately). Gurney and Jackson, 33, Paternoster Row, London, E.C. 1658 pages, 9 × 5½ in. Price £3 3s. net.

The large amount of new matter accumulated since the publication of the fourth edition of this work in 1909 has necessitated the addition of over 500 pages, and accordingly it now extends to three volumes, the first two being devoted to coal tar and the last to ammonia. The whole of the subject matter has been revised and brought up to date. The most important additions are to be found in the third volume, in which the modern processes for manufacturing ammonia from atmospheric nitrogen are fully dealt with. Many of the other sections have been enlarged, particularly those on naphthenes, pitch for briquetting, anthracene, examination of carbolic oil and carbolic acid, purification and testing of naphthalene, carburetted gases, and liquefied (anhydrous) ammonia. Among the new sections may be noted particulars of the estimation of tar in gases and the removal of tar fog, recovery of toluene from gas, purification of pitch by treatment with solvents, pitch cancer, use of anthracene oil for removing naphthalene from gas, synthetic production of phenol, condensation products of phenols with formaldehyde, treatment of tar oils with phosphoric acid, and ammonium chlorate, formate, oxalate, and perborate.

BULLETIN OF THE IMPERIAL INSTITUTE. Vol. XIV. No. 2. April to June, 1916. Price 2s. 6d. (post free, 2s. 9d.).

This issue of the Bulletin contains the results of investigations in connection with edible beans from Burma, *Voandzeia subterranea* beans from the Sudan, naked barley from Cyprus, water-melon seeds from the Sudan, colocynth pulp from the Sudan, paper-making materials from South Africa, African wild silk, and whales' bones from the Falkland Islands. Other articles deal with the occurrence and utilisation of nickel ores; sapphire-mining industry of Anakie, Queensland; and sources of supply of hazel-nuts. In addition,

there are notes on the co-operation of the Chambers of Commerce with the work of the Imperial Institute, the Report of the Committee on West African oil seeds, recent investigations on sources of potash, etc.

The Bulletin also contains a section dealing with recent progress in agriculture, and the development of the natural resources of the Colonies, India, and the Tropics generally.

REATTIVI E REAZIONI. Di E. TOGNOLI. U. Hoepli, Milan. XII + 277 pages, 8½ × 4½ in. Price L.3.50.

THE most important section of this little book consists of a collection of the reagents and reactions which have proved of value in analytical chemistry, especially in medico-legal and clinical practice and in the examination of foods. The list of reagents and reactions, arranged alphabetically, under the names of the authors, occupies 167 pages; and there are given also an alphabetical list of substances for which reactions are described; tests of purity for the more important reagents; a chapter on test-papers; and tables of atomic weights, and of specific gravities of solutions of alkalis, acids, ethyl alcohol, methyl alcohol, glycerol, and dextrose.

THE ANALYSIS OF PERMISSIBLE EXPLOSIVES. By C. G. STORM. U.S. Bureau of Mines, Bulletin 96. Government Printing Office, Washington. 88 pages. Price 15 cents.*

A DESCRIPTION of the methods used by the U.S. Bureau of Mines for the analysis and testing of "permissible" explosives.

THE SAND TEST FOR DETERMINING THE STRENGTH OF DETONATORS. By C. G. STORM and W. C. COPE. U.S. Bureau of Mines, Technical Paper 125. Government Printing Office, Washington. 68 pages. Price 10 cents.*

THIS paper describes the results of a systematic investigation of the "sand test" devised by W. O. Snelling in 1913 (see page 1132).

MINES AND QUARRIES: GENERAL REPORT, WITH STATISTICS, FOR 1915. By the CHIEF INSPECTOR OF MINES. Part I. Divisional Statistics. [Cd. 8361.] Price 6½d. (post free 8½d.).

THIS return, which forms the first part of the General Report on Mines and Quarries for 1915, contains statistics of the number of persons employed, the output of minerals, and the accidents at mines and quarries in the United Kingdom, arranged according to the inspection districts.

SOME FOREIGN SPECIFICATIONS FOR RAILWAY MATERIALS: RAILS, WHEELS, AXLES, TYRES. By G. K. BURGESS and P. D. MERICA. U.S. Bureau of Standards, Technologic Paper No. 61. Government Printing Office, Washington. 132 pages. Price 25 cents.*

IN an introductory chapter the authors discuss and give a résumé of the specifications, together with some accident statistics. Specifications of the following countries are given:—United Kingdom, Italy, France, Belgium, Germany, Austria, Holland, Sweden.

EXTRACTION AND RECOVERY OF RADIUM, URANIUM, AND VANADIUM FROM CARNOTITE. By C. L. PARSONS, R. B. MOORE, S. C. LIND, and O. C. SCHAEFER. U.S. Bureau of Mines, Bulletin 104, Mineral Technology 12. Government Printing Office, Washington. 124 pages. Price 25 cents.* (See this Journal, 1916, 44.)

* A certain number of these publications can be obtained free on application to the respective Government Departments. In the case of the U.S. Government publications, when this supply is exhausted, copies can be obtained at the prices mentioned on the Superintendent of Documents, Washington, D.C., U.S.A.

